THE WHAT'S NEW MAGAZINE

JUNE 1997 $2.99
CANADA $3.99

Popular Science

THE F-22
Quicker, Stealthier, Deadlier

Electronic SHARK Repellent

7 HOTTEST SPORTS CARS

UFO Mania at ROSWELL

What really crashed in New Mexico 50 years ago? Tens of thousands of UFO believers and debunkers will make a pilgrimage to sort out fact from fiction.

CELEBRATING 125 YEARS OF POPULAR SCIENCE

A TIMES MIRROR MAGAZINE

www.popsci.com

The 110-Passenger Mer

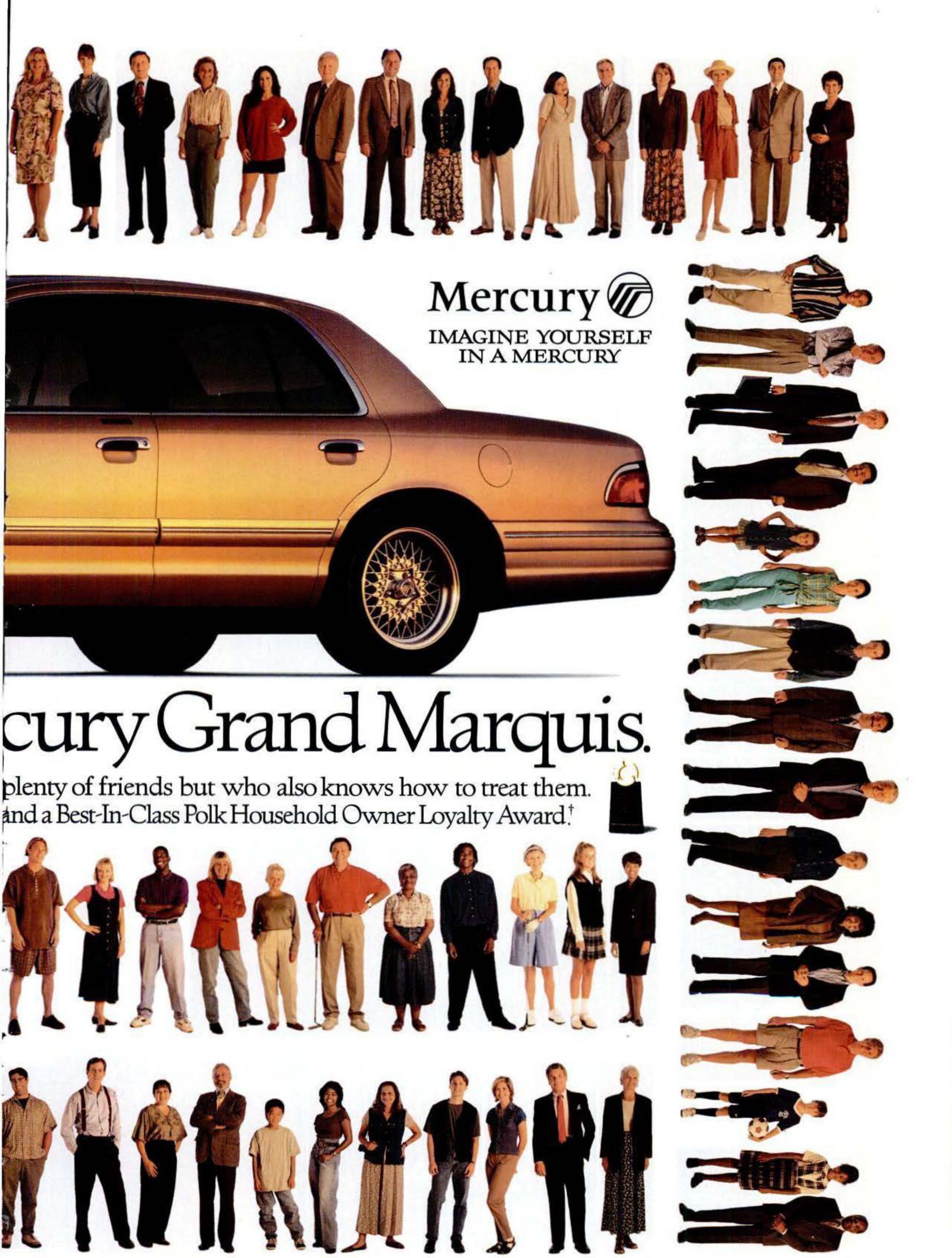
Smooth, roomy, quiet and powerful. For the person who not only has

★★★★★ Winner of both a Five-Star Rating in government crash tests

Ford Credit

[1]Driver and passenger front crash test data only useful in comparing vehicles within 500 lbs. Loyalty information based on 1996 Polk Companies data and New Vehicle Customer Survey.

Copyrighted material



Copyrighted material

A billion-dollar renovation and look at the reaction we get.

We're making every Holiday Inn® hotel as good as the best Holiday Inn hotel.

In many places, that means new mattresses and sofas. New wallpaper and drapes. New carpeting. Renovated lobbies and exteriors. Dataports and state-of-the-art electronic door locks. It's enough to put you to sleep, isn't it?

On the way.

1-800-HOLIDAY http://www.holiday-inn.com

©1997, Holiday I

nc. All rights reserved. Most hotels are independently owned and/or ope

This One
KF1Q-23R-RDBR
Copyrighted material

Can you really enjoy smooth satisfying taste at lower tar? Absolutely.

I can!

You've got MERIT

© Philip Morris Inc. 1997

SURGEON GENERAL'S WARNING: Smoking By Pregnant Women May Result in Fetal Injury, Premature Birth, And Low Birth Weight.

Ultima: 1 mg "tar," 0.1 mg nicotine—Ultra Lights: 5 mg "tar," 0.4 mg nicotine—Kings: 8 mg "tar," 0.6 mg nicotine av. per cigarette by FTC method.

Copyrighted material

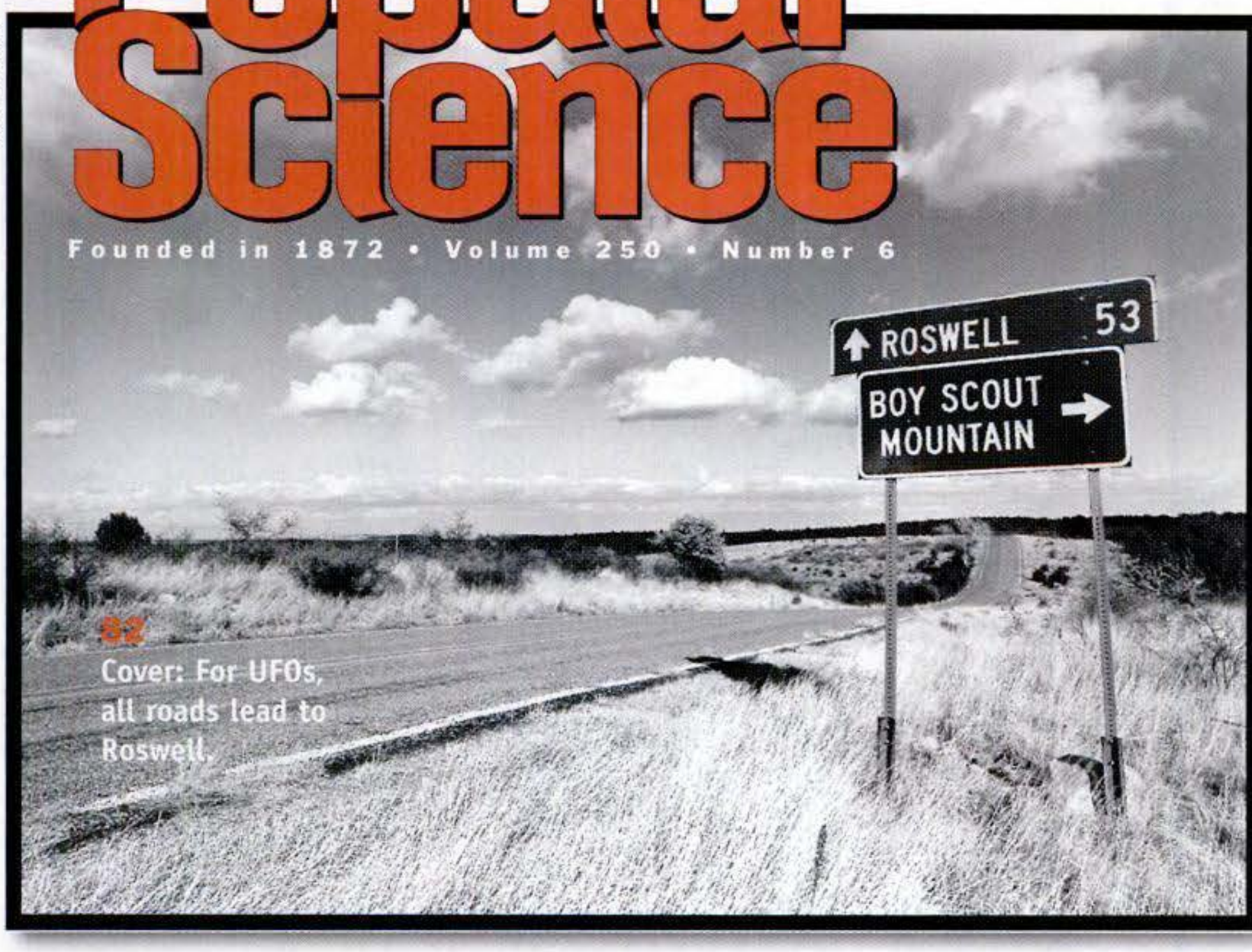
JUNE 1997

THE WHAT'S NEW MAGAZINE

Popular Science

Founded in 1872 • Volume 250 • Number 6

JOHN B. CARNETT



82 Cover: For UFOs, all roads lead to Roswell.

COVER ART
Photograph: JOHN B. CARNETT
Composed by: TOM WHITE

DEPARTMENTS

20 WHAT'S NEW Stone Age plant; Leonardo's legacy; limited edition Apple.

7 LETTERS

13 125 YEARS OF POPULAR SCIENCE Weaponry and military technology.

120 FYI Braking the Enterprise; what is antimatter?

140 LOOKING BACK

SCIENCE & TECHNOLOGY

43 Science & Technology Newsfront $180 million repairs for the world's most widely used aircraft.

82 COVER STORY 50 Years After Roswell Skeptics and believers flock to New Mexico to celebrate the most legendary of UFO crashes.

90 Stone Age Kin A British teacher traces his family tree back to a 9,000-year-old skeleton.

COMPUTERS & SOFTWARE

37 Computers & Software Newsfront Next-generation Internet; tinier digital cameras.

97 Electric Tales Computer chips replace wood chips in the pages of a 21st century book.

ELECTRONICS

61 Electronics Newsfront Home theater becomes a private moment with Auri receiver, transmitter.

94 A Shock for Sharks Swimming near a Great White no longer means becoming his lunch.

AVIATION

102 Top Gun Bambi meets Godzilla in tomorrow's fighter: The F-22 combines agility and stealth with brute force and deadly speed.

HOME TECHNOLOGY

59 Home Technology Newsfront Lightweight concrete from wheat; what's living in your shower nozzle?

AUTOMOTIVE

50 Automotive Newsfront Mercedes goes for V6; laser tollbooths; Regal's renaissance.

110 Jazzy Quartet Four marvelous sports cars in the $40,000 range arrive in the same year: Chevy Corvette, BMW Z3, Mercedes SLK230, Porsche Boxster.

116 Top-of-the-line Trio We test the $70,000-and-up Jaguar XK8, Acura NSX, and Dodge Viper GTS Coupe.

www.popsci.com
AOL Keyword: popsci

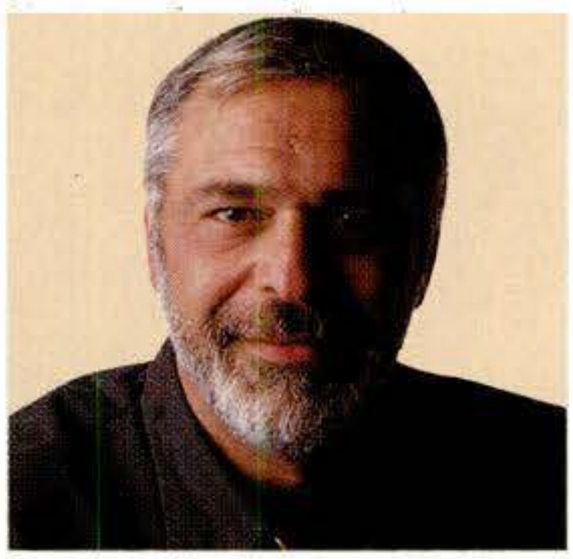
Have you ever seen a grown man cry?

Those who appreciate quality enjoy it responsibly.

©1995 CROWN ROYAL • IMPORTED IN THE BOTTLE • BLENDED CANADIAN WHISKY • 40% ALCOHOL BY VOLUME (80 PROOF) • JOSEPH E. SEAGRAM & SONS, NEW YORK, NY

Copyrighted material

FROM THE EDITOR-IN-CHIEF



Not Necessarily the News

DAYS BEFORE THE HEAVEN'S GATE mass suicide story broke, the Internet was abuzz with weird supernatural theories about the Hale-Bopp comet. A day after the shocking discovery, the "Today Show" featured a deadly serious interview with Whitley Strieber, the author of *Communion*, the supposed nonfiction book that many consider to be the seminal account of alien abduction. Then I get a call from a producer of docudramas, looking for a lead to an alien abductee on which to base a TV movie. I ask: "Do you believe that such an event ever took place?" The producer says it doesn't matter, as long as the subject thinks it was real. What's happening here? Has a sensational story and a spate of highly suggestive scientific findings—from evidence of water on one of Jupiter's moons to indications of life on Mars—simmered together to obliterate the distinction between unsubstantiated speculation and well-disciplined scientific hypothesis? UFO-ology is entertaining. But when the "X-Files" and the network news are covering the same territory, we have reason to worry.—*Fred Abatemarco*

Broken Barrier

YOU'RE WRONG TO write that "there is no past indicator to tell what happens when a land vehicle breaks the sound barrier" [From the Editor-in-Chief, Feb.]. On December 17, 1979, Stan Barrett broke the sound barrier on land at Edwards Air Force Base in California while driving Hal Needham's Budweiser Rocket. Barrett reached a top speed of 739.666 mph (Mach 1.0106), but because he was timed in only one direction, his time is not an official record. Official or not, he did break the sound barrier.

William J. Rebber
Big Bear City, Calif.

COURTESY: HAL NEEDHAM

As the vehicle that "unofficially" topped the sound barrier, the Budweiser Rocket is in the collection of the Smithsonian in Washington, D.C.

You are correct. Stan Barrett used a vehicle called the Budweiser Rocket to break—unofficially—the sound barrier. When he exceeded 600 mph, he fired a Sidewinder missile to propel himself faster. "I felt a lot of hard buffeting [as I broke the sound barrier], then everything smoothed out. Then it felt like I hit a wall when the engines quit—and my speed decelerated 80 to 90 mph in the first second," Barrett says.

The Electric Experience

AS ONE OF the first to lease an EV1, I read "Driving on a Charge" [April] with great interest. In contrast to your article, my experience the past four months has been very satisfactory. The car has more than enough energy for my 50-mile round-trip daily commute. I have tested the limits of my EV1 several times, and it has passed every time. On my latest test I drove 106.3 miles on a single charge. My EV1 is comfortable, has a terrific stereo, and can't be beat as an attention getter. People are always waving and giving me a "thumbs up." Best of all, I drive the cleanest car on the road—the one without the tailpipe.

Marvin V. Rush
Sunland, Calif.

IN "DRIVING ON A CHARGE," you try to do a "real world" test, but you use a Lexus as a comparison car. The EV1 is supposed to be an energy-saving, short-trip commuter car, not a luxury car. A Honda Civic or a Plymouth Neon would have been more appropriate.

Steve Jordan
stevejordan@mindspring.com

HOW TO CONTACT US

Address: 2 Park Ave., New York, NY 10016
Fax: 212-481-8062

ARTICLE INQUIRIES
We have listed the city and state for companies mentioned in our articles. For further assistance:
E-mail: reader@popsci.com
www.popsci.com/context/resources
Fax: 212-481-8062

LETTERS
Comments may be edited for space and clarity. We regret that we cannot answer unpublished letters.
E-mail: letters@popsci.com

QUESTIONS FOR FYI
We answer your questions in the Ask Popular Science section of FYI. Only letters for publication can be answered.
E-mail: askpopsci@popsci.com

SUBSCRIPTION INQUIRIES
For subscription or delivery problems, or change of address please write to:
Popular Science
P.O. Box 51286
Boulder, CO 80322
Phone: 800-289-9399
E-mail: popsci@neodata.com

POPULAR SCIENCE ONLINE
Visit our World Wide Web site at
http://www.popsci.com

Popular Science

Copyrighted material

THINK OF IT AS A CROSS BETWEEN A

▪ Built Ford Tough from stem to stern. ▪ The best quality* and highest owner loyalty** ratings of any full-size van.
▪ New available 4.6L and 5.4L Triton™ V-8s for more V-8 torque and horsepower than before. ▪ Dual air bags
▪ Only safety belt pretensioner in a van for added safety in the event of a frontal collision. ▪ All-new ergonomically

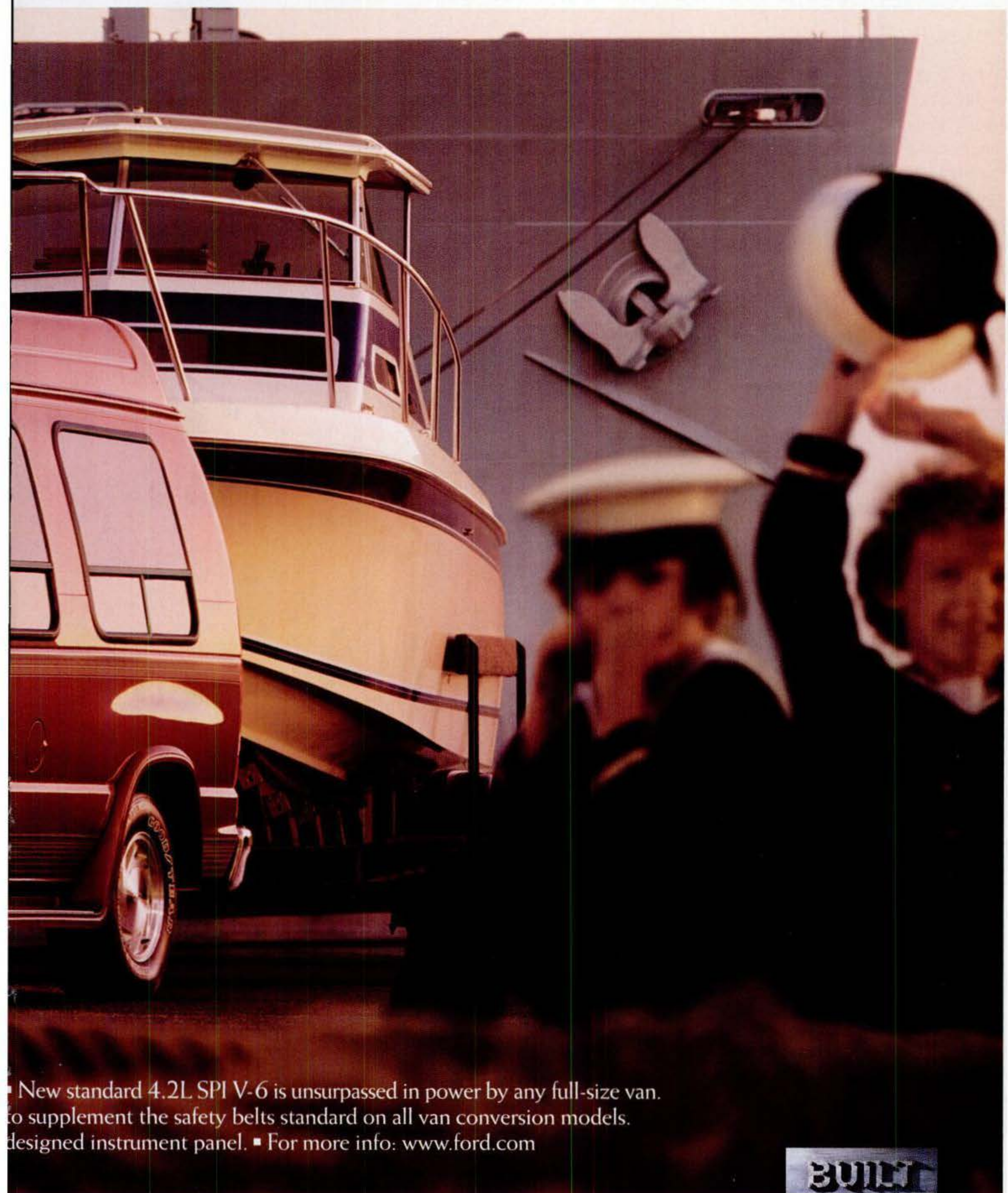
*Based on an average of consumer-reported problems at 3-months' ownership in a survey of Ford and competitive models. **Based on '93, '94 and '95 New Vehicle Customer Survey.

THE NEW ECONOLINE FOR VAN CONVERSIONS.

A BETTER VAN TO BEGIN WITH.

Copyrighted material

LUXURY LINER AND A BATTLESHIP.



▪ New standard 4.2L SPI V-6 is unsurpassed in power by any full-size van.
to supplement the safety belts standard on all van conversion models.
designed instrument panel. ▪ For more info: www.ford.com

BUILT Ford TOUGH

Copyrighted material

Frozen Pipes

I READ WITH great interest your article "The Physics of Freezing Pipes" [Home Technology Newsfront, Feb.] and the solution to the problem—a modified faucet washer that enables the faucet to leak a little under high pressure. However, the new washerless faucets (the most expensive units) would present difficulty. An alternative would be to have water-hammer stub tubes installed before or after all faucet-supply stubs. The length of the water-hammer stub could control the anticipated expansion of the ice.

Don Berg
San Jose, Calif.

Good point, and one that did not escape the engineers at the University of Illinois who conducted the research. Instead of stub tubes, however, they used small bladders inside the pipes to absorb water expansion and prevent bursting.—Ned Nisson

Aspirin Remedy

IN "EXTREME CLOSE-UP" [What's New, March], you showed a photomicrograph of salicylic acid and said that salicylic acid is "simple aspirin." Aspirin is really acetylsalicylic acid, a synthesized variation of salicylic acid. Salicylic acid is found in the bark of willow trees and various species of *Spiraea*.

Mark Austin
n8vzr@sojourn.com

Corrections: A computer is needed to print from the Ibid whiteboard. Ibid cannot be wired directly to a printer [What's New, March].

Formula One engines are 3.0 liters, not 3.5 ["The Technology of Speed," March].

The Hewlett-Packard printer that offers photo ink cartridges is the DeskJet 693C ["Get the Digital Picture," March].

Popular Science

Editor-in-Chief & President Fred Abatemarco
Editor Cecilia Wessner
Art Director Christopher Garcia
Managing Editor Candace Golanski
Science Editor Dawn Stover
Automotive Editor Dan McCosh
Technology Editor Frank Vizard
Departments Editor Mariette DiChristina
Copy Chief Bob Sillery
Online Editor Suzanne Kantra Kirschner
Associate Art Director Ronan J. Keane
Assistant Art Director Russell Hantman
Staff Photographer/Photo Editor John B. Carnett
Graphics Production Coordinator Isabel Zambito
Graphics Consultant John Grimwade
Assistant Editor William L. Thieriot
Editorial Assistant Kai Wu
Executive Assistant Marcie Mason
Science Editor Emeritus Arthur Fisher
Senior Contributing Editor Chris O'Malley
Far East Editor Dennis Normile
Contributing Editors Stephen A. Booth, Stuart F. Brown, Andrew Chaikin, Robert Gannon, Judith Anne Gunther, Don Sherman, P. J. Skerrett, Gina Smith, Tony Swan, Bill Sweetman, Mark D. Uehling
Editorial Intern Kevin Miller

Popular Science Properties
Vice President & Publisher John B. Crawley
Vice President, Business Development Deb Lees
Advertising Director Michele Folman
Eastern Advertising Office: Bill Buchanan, Ann Cusack, Allyson Deane, Lisa Friedman, Chris Leins, Beth Wayne, Brenda Charles (212) 779-5000
Midwest Advertising Office: Manager Hans Theisen, Brian Stalzer, Dawn Zabel (312) 337-7896; **Los Angeles Advertising Office: Manager** William M.C. Miller, Moira Shepard (310) 315-4380; **Detroit Advertising Office: Manager** Bob Baumuller, Lynne Gushman (810) 350-3800; **San Francisco Advertising Office: Manager** Ed Gotfredson (415) 954-8525
Direct Response Advertising: Diane Pahl, (313) 730-9717.
Classified Advertising Sales: Elizabeth Irving, Brian Levine (212) 779-5000
Sales Development Director Ellen Pedersen
Research Director Yolanda Sandulescu
Promotion Director Joanne Greco
General Manager Jill Raufman
Associate Business Manager John Waye
Advertising Coordinator Gina Gregory
Consumer Marketing Director Dan Dynan
Director of Retail Sales Marcia Orovitz
Production Director Laurel Kurnides
Production Assistant Toni Peterson
Prepress Manager John Francesconi

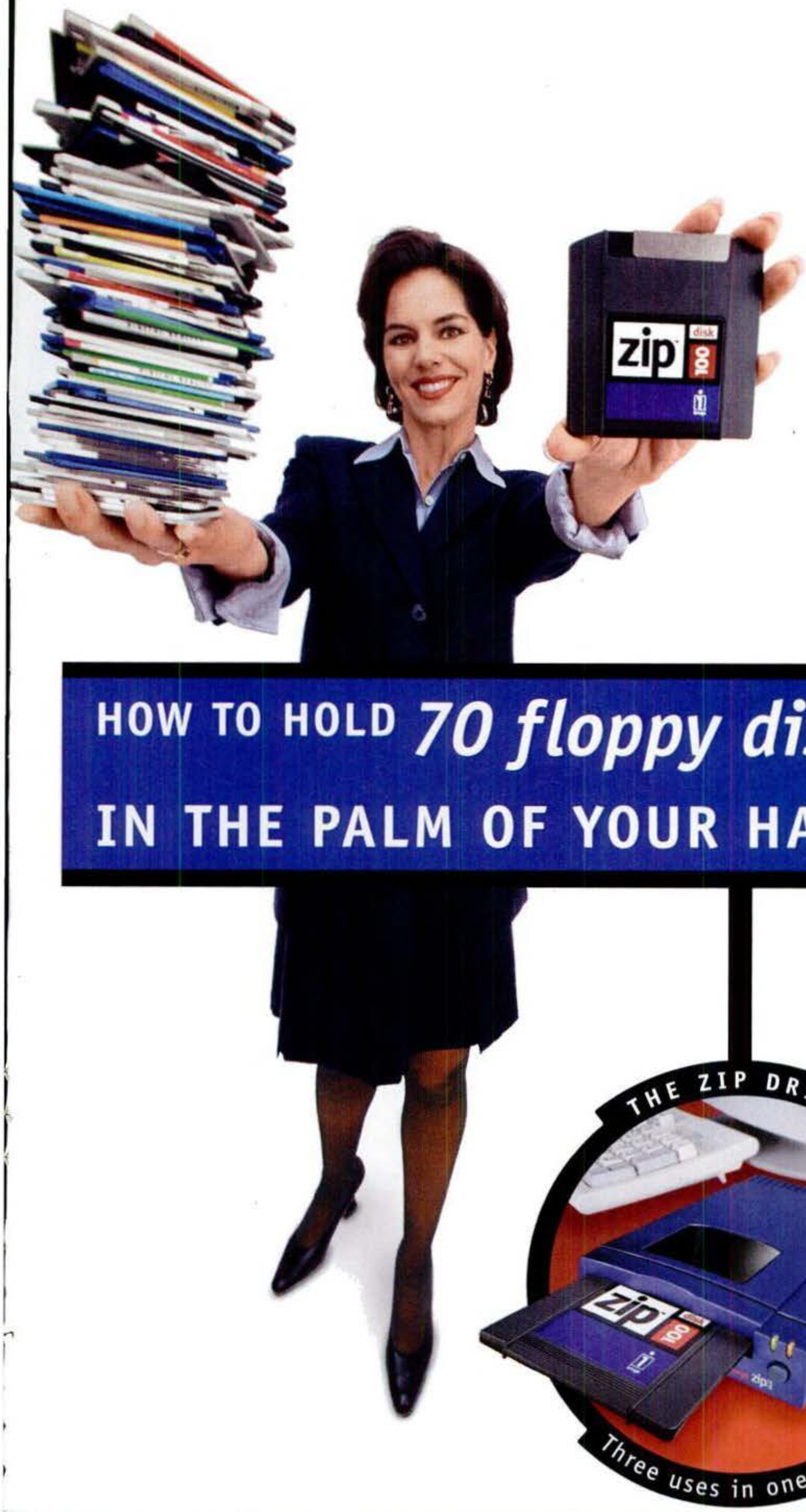
Times Mirror Magazines

President & Chief Executive Officer Efrem Zimbalist III
Senior Vice President/Finance & Administration Michael J. Haugh
Senior Vice President/Operations & Multimedia Scott W. Kabak
Senior Vice President Fred Abatemarco
Senior Vice President Jason E. Klein
Senior Vice President James Nuckols
Senior Vice President/Business Innovation Nancy C. Walker
Vice President/Accounting Nicholas A. DeCarlo
Vice President/Finance Kerry Larmore
Vice President/Human Resources Kathleen Casey
Vice President/Manufacturing Kit Taylor
Vice President/Information Systems Robert Cudworth
Vice President/Administrative Services James F. Green
Director/Telemarketing Richard Goldberg
Director/Corporate Sales Nicholas M. Ricci
Director/Multimedia Dominic Schmitt

ZIP™ DRIVE. CONSIDER IT STANDARD EQUIPMENT. THESE GUYS DO.

Make sure your next computer has a Zip drive, the new industry standard, pre-installed in systems from these leading manufacturers.

Packard Bell.
NEC
IBM
DELL
GATEWAY2000
HEWLETT PACKARD
MICRON ELECTRONICS
PowerComputing
UNISYS



NEW, LOWER PRICE.
Visit your local retail store or corporate reseller, or you can even see us at: www.iomega.com

TONS OF STORAGE SPACE.
Increase your storage space — 100MB at a time for as low as $12.95 per disk after rebate. Perfect for storing and running your whole office.

COMPLETE PORTABILITY.
The Zip™ drive and Zip disks are small, lightweight, and rugged. Which means you can take work home, on the road, or anywhere else you need to go.

FAST, EASY BACKUP.
Hooks up fast to your PC or Mac. And, at up to 20 times faster than that old floppy drive, it's great for making copies of everything. So the next time your computer spazzes out, you won't.

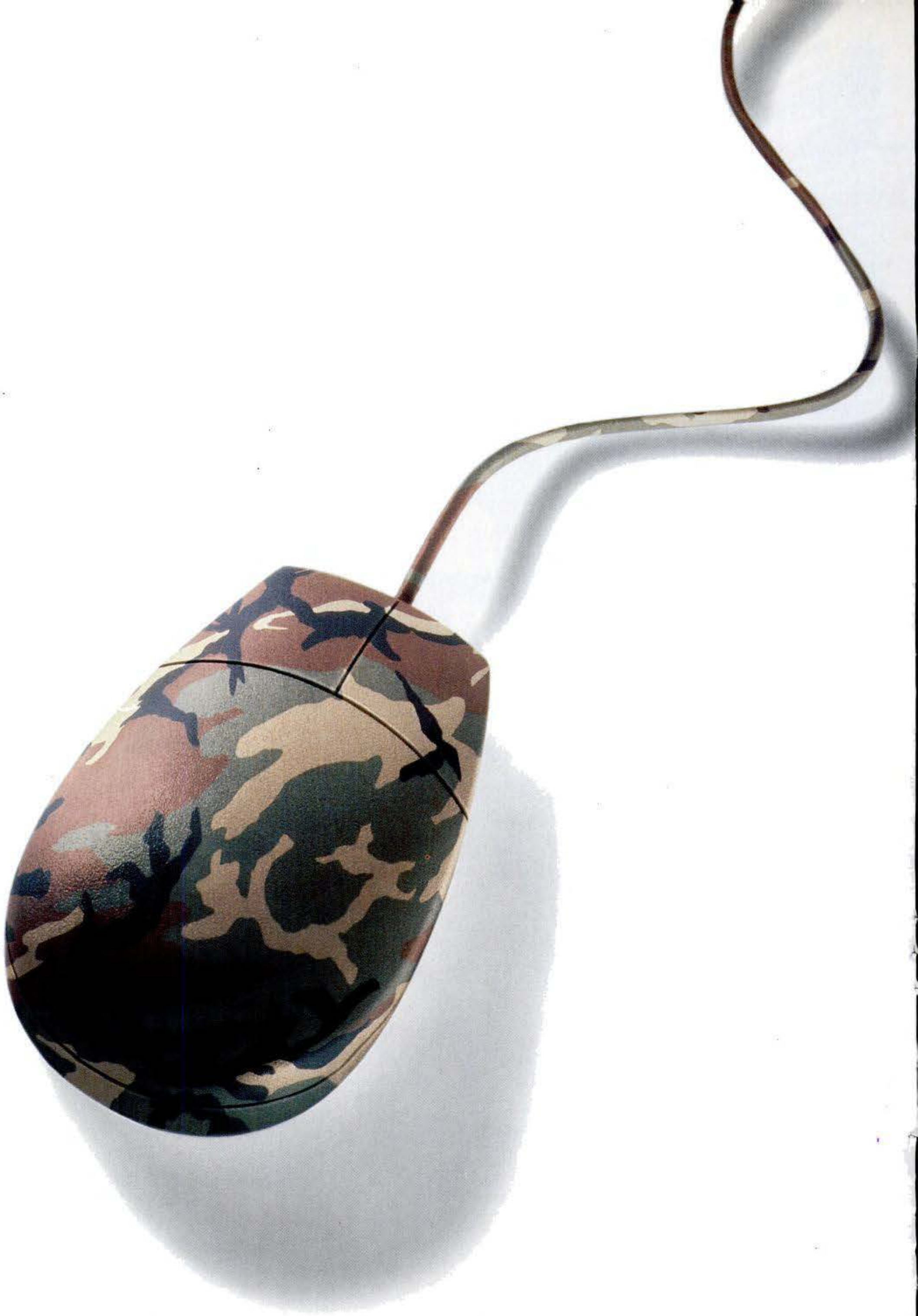
OVER FIVE MILLION OUT THERE. Forget about that old floppy drive. Zip drives are everywhere; at home, in schools, and at the office. In fact, they're the perfect complement to the enhanced audio and visual capability of today's MMX™ technology-based systems. And with so many Zip drives out there, it's more than just compatible, it's universal.

BECAUSE IT'S YOUR STUFF.™

iomega.

©1997 Iomega Corporation. Iomega and the Iomega logo are registered trademarks, and Zip and "Because It's Your Stuff" are trademarks of Iomega Corporation. MMX is a trademark of Intel Corporation. All other trademarks are the property of their respective holders. Prices listed are estimated street prices. Actual prices may vary. Zip is compatible with Windows® 95, 3.1, NT, DOS, OS/2, and Mac OS. Up to 20 times faster using the SCSI or IDE models, up to 5 times faster using the parallel port model.

Copyrighted material



Ready. Aim. Click.

www.goarmy.com
BE ALL YOU CAN BE.

1-800-USA-ARMY

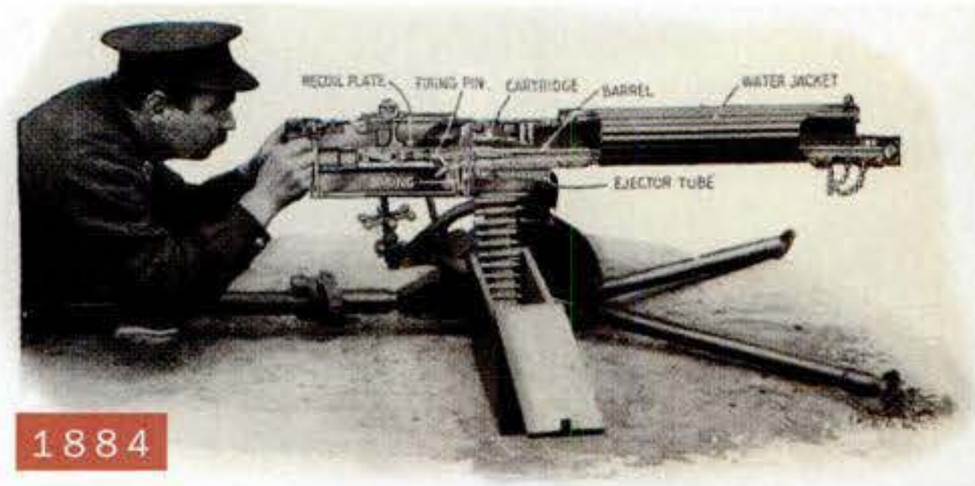
Copyrighted material

EDITED BY BOB SILLERY

Additional research by Kai Wu

Military Technology

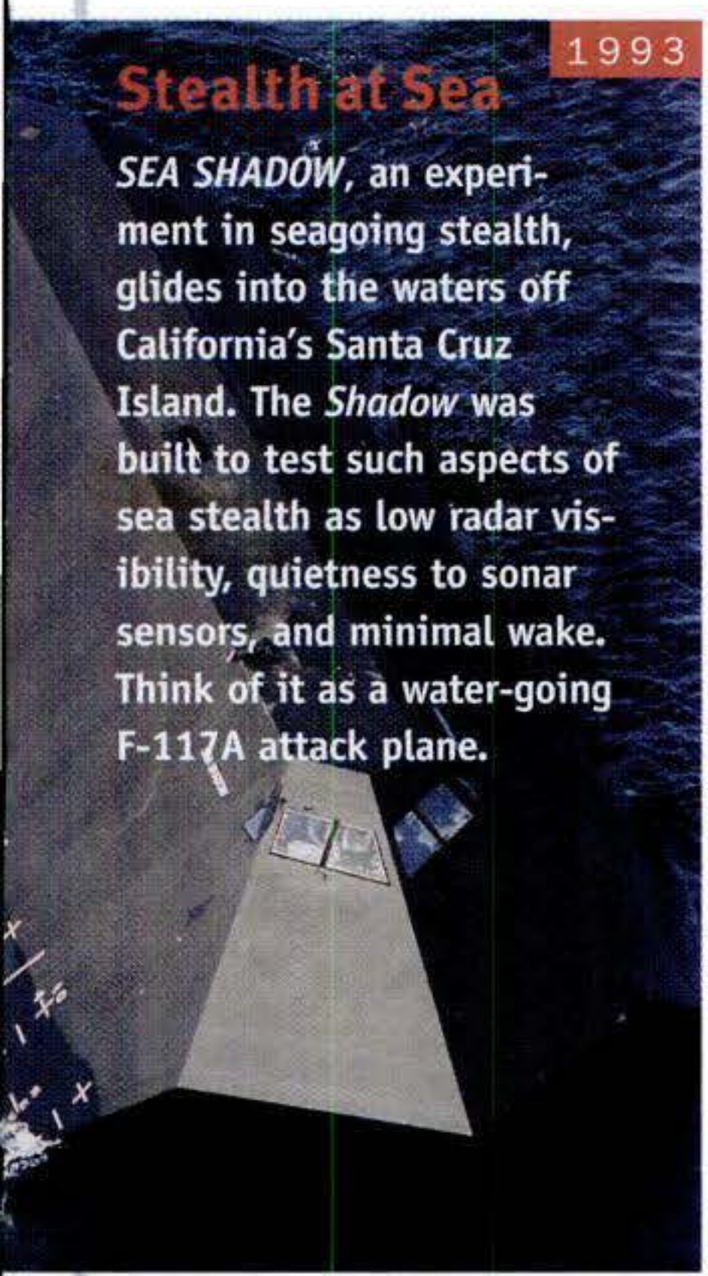
The science of warfare and weaponry.



1884

Maximum Firepower

THE FIRST AUTOMATIC machine gun is invented by Hiram Maxim in 1884. The Maxim uses the recoil of the cartridge, rather than hand power, for loading and firing. Such weapons attain unheard-of firing rates of 600 shots per minute, more than three times that of earlier technology, we note in 1888. The new "chattering" guns prove devastatingly lethal in World War I.



1993

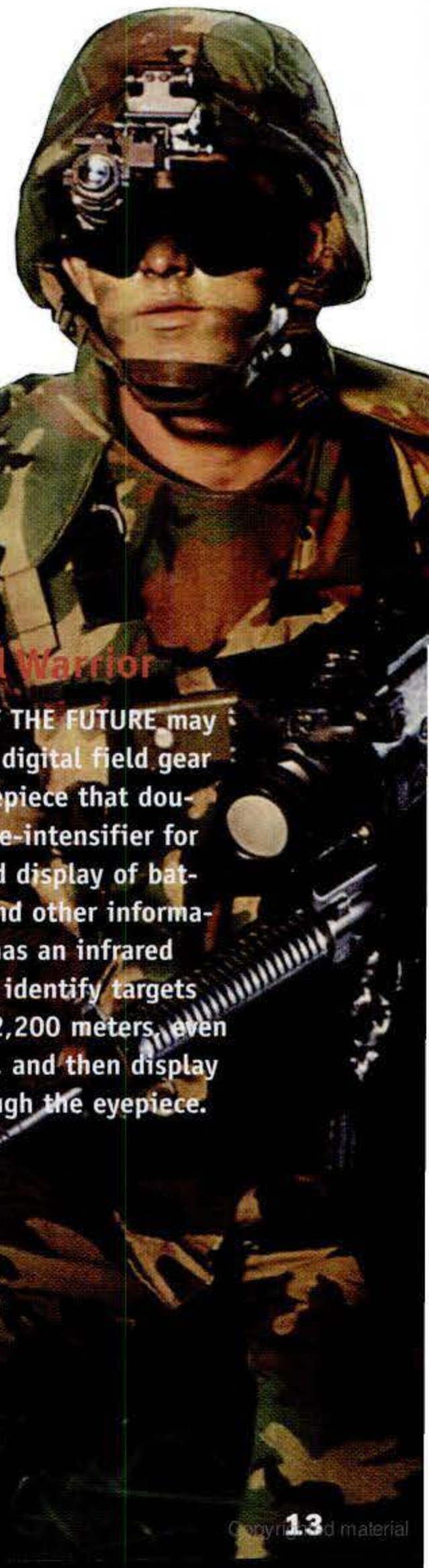
Stealth at Sea

SEA SHADOW, an experiment in seagoing stealth, glides into the waters off California's Santa Cruz Island. The *Shadow* was built to test such aspects of sea stealth as low radar visibility, quietness to sonar sensors, and minimal wake. Think of it as a water-going F-117A attack plane.

1991

Top-of-the-Line Tank

IN WWI, tanks first appeared in the battles of Somme and Verdun. Thereafter, land warfare would be mobile. In 1991's Desert Storm, the M1A1 Abrams wields a mine-clearing prow and thermal-imaging system for finding targets in darkness or smoke.



JOHN B. CARNETT

1994

The Digital Warrior

THE SOLDIER OF THE FUTURE may well sport such digital field gear as an exotic eyepiece that doubles as an image-intensifier for night vision and display of battlefield maps and other information. The rifle has an infrared sensor that can identify targets as far away as 2,200 meters, even through foliage, and then display the image through the eyepiece.

Countering Gas Warfare

1915

ACROSS THE TRENCHES of "the war to end all wars," a hideous weapon—poisonous gas—is unleashed. Soon, every Allied soldier is equipped with a mask. In June 1991, we show a Gulf War-era mask that lets soldiers drink from canteens without taking off masks.

JANA BRENNING

Copyrighted material

He doesn't know what a phonograph is.

He's never heard of 8-track.

The only time he saw an LP was in his

grandparents' attic.

CDs and diskettes are his parents' toys.

What will his be?

Copyrighted material

Walkman Home VCR CD Digital Satellite System What's next?

SONY

Copyright material

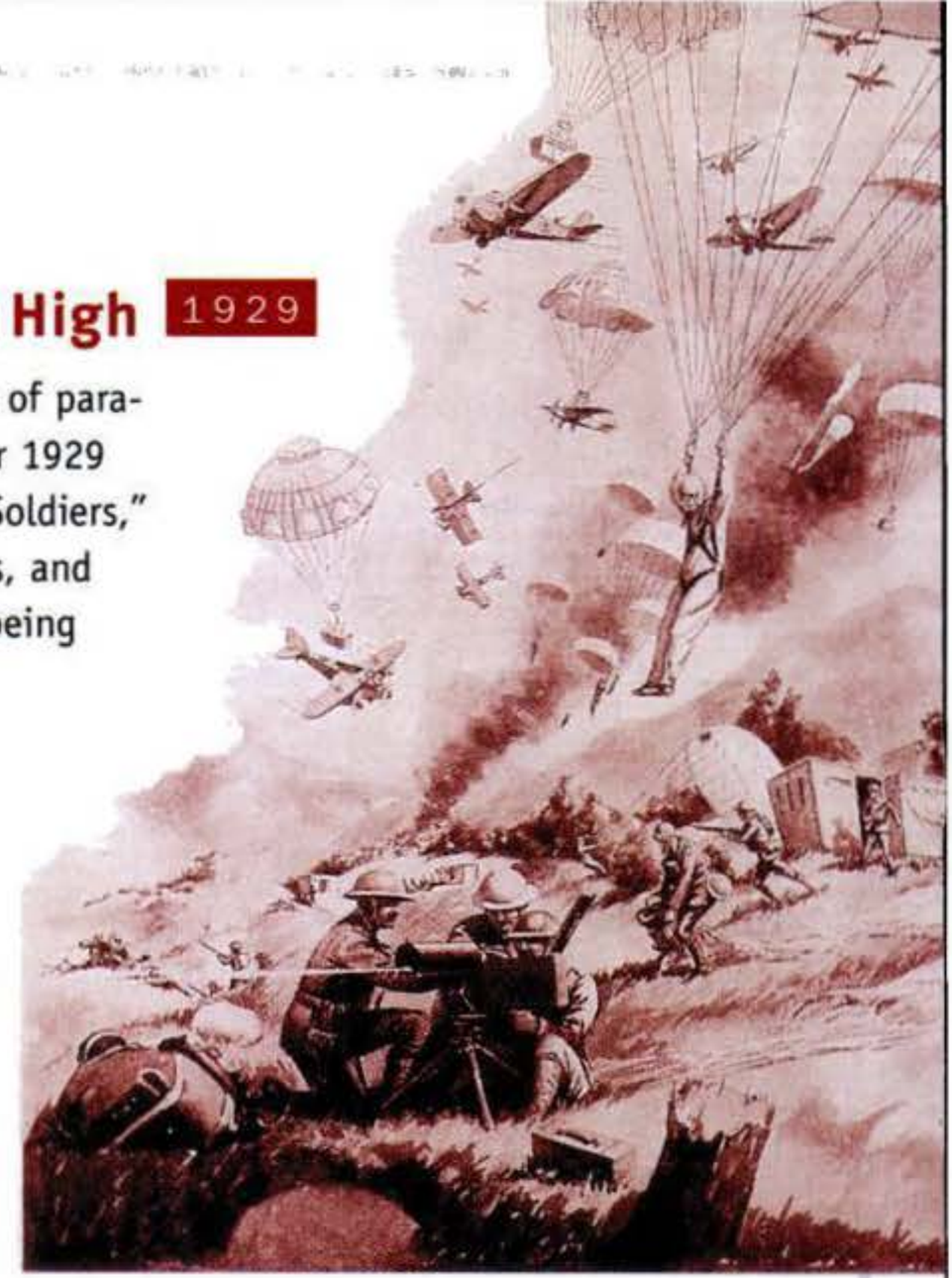
1991

Light in the Darkness

WITH THE AVIATOR'S Night Vision Imaging System, Desert Storm pilots can fly at light levels as low as "overcast starlight." The system uses a sensitive gallium arsenide photocathode to detect photons, then amplifies the brightness of the image more than 25,000 times for a vivid phosphorescent view.

Attacking from On High 1929

PREDICTING THE importance of paratroops in "the next war," our 1929 story, "When the Sky Rains Soldiers," envisions bullet-proof cabins, and even airplanes themselves, being dropped from the skies.



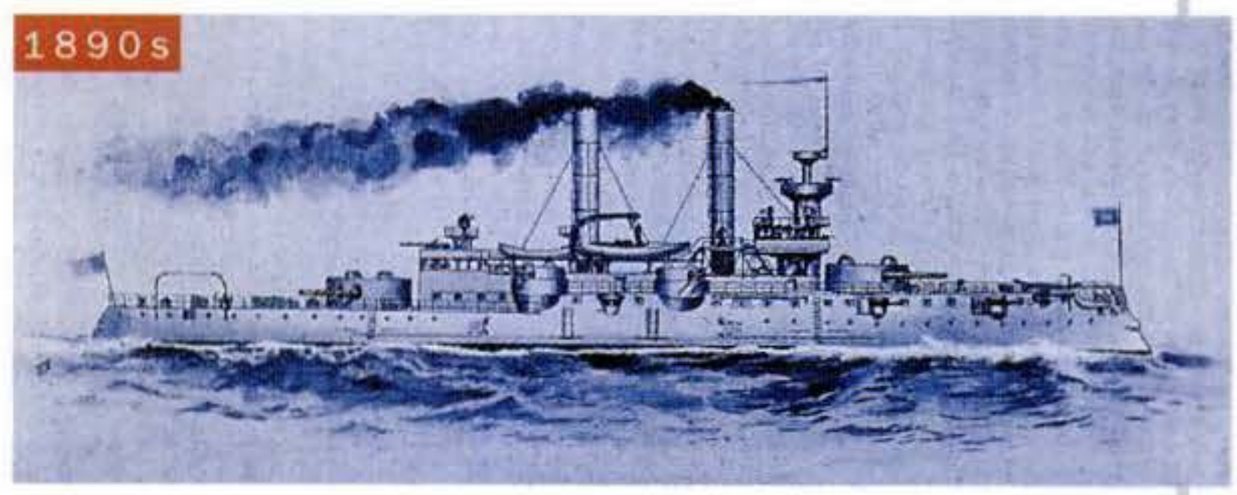
"Pineapples of Death" 1944

AS WORLD WAR II rages, POPULAR SCIENCE reports that the hand grenade, "probably the oldest firepower weapon, is still a decisive factor in hand-to-hand combat." Its notched surface earned it the ominous sobriquet, "pineapple of death." Primitive earthenware grenades were probably being used as long as a thousand years ago.

Enter the Ironclads

THE DESTRUCTIVE POWER of torpedoes and cannons render wooden ships obsolete and give rise to an armada of iron battleships, cruisers, and torpedo boats. The 1862 Civil War clash of the *Monitor* and the *Merrimac* give the nation's fighting fleet a preview of armored power. Such ships as the *Iowa*, pictured here in 1893, soon follow. The Iowa's guns help win the Spanish-American War in 1898.

1890s



Also Noted...

- 1909 Wright Flyer is Army's first plane.
- 1954 *U.S.S. Nautilus*, first nuclear-powered submarine, is launched
- 1961 *U.S.S. Long Beach*, first nuclear-powered cruiser, is completed.
- 1965-1975 Helicopters play a dominant role in Vietnam War.
- 1991 High Mobility Multipurpose Wheeled Vehicles, or humvees, are a jack-of-all trades in the Gulf War; mine clearer makes passageways safe.
- 1994 Nonlethal weapons and computerized camouflage are developed.
- 1996 Sure Strike, a targeting system using lasers and GPS, is deployed in Bosnia.

Smart Missiles 1978

POPULAR SCIENCE begins unveiling early models of "smart" cruise missiles, beginning with a Boeing prototype in 1978. We showcase the "Engineering Secrets of the Smart Missile," and its effect on the Falkland Islands War in October 1982. In an April 1991 story, "High-Tech Hits on Iran," we provide step-by-step detail of a Tomahawk's hit on a Bagdad telecommunications center.

Copyrighted material

What's next is now.

We developed the CD.

Which changed the way we listen to music.

But the DVD will change much more.

Like the way we watch movies.

Listen to multichannel sound.

Even enjoy our computers.

One single DVD disc (which looks just like a CD)

can store a full-length motion picture in digital surround sound.

Taking home theater to a new level.

Not to mention, new places.

Because someday, you'll be able to watch DVDs on the go,

and on a computer, too.

Plus, our DVD video player will also play your music CDs.

Our DVD-ROM drive will play your CD-ROMs.

We thought you'd like the digital world.

Digital Dream Kids
www.sony.com/electronics

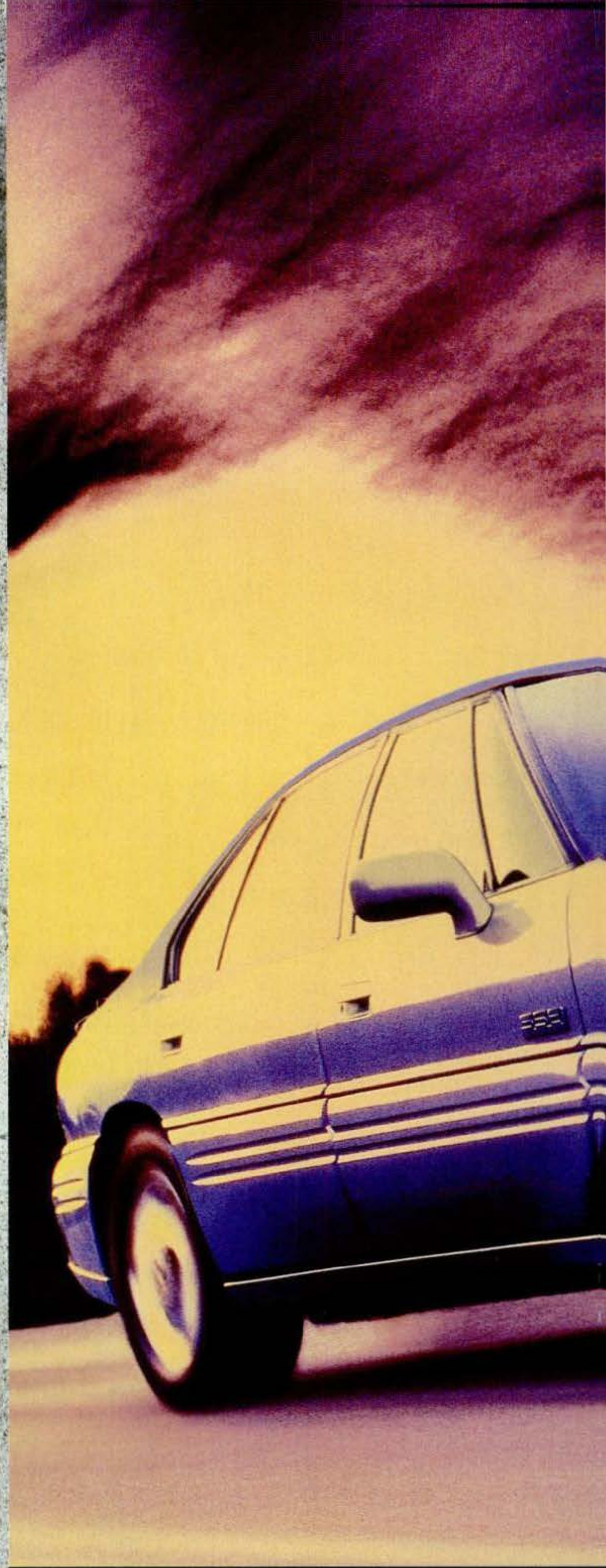
©1997 Sony Electronics Inc. Reproduction in whole or in part without written permission is prohibited. All rights reserved.
Sony, Handycam, Walkman, and Trinitron are trademarks of Sony. WebTV is a trademark of WebTV Networks, Inc.

SONY

Copyrighted material

MAY TRADITIONAL LUXURY CARS REST IN PEACE.

HEY, YOU'RE NOT DEAD YET. TAKE CONTROL OF YOUR DRIVING ENVIRONMENT. FIND THE RELATIONSHIP BETWEEN ROAD AND CAR...CAR AND DRIVER. THIS IS THE SUPERCHARGED BONNEVILLE® BY PONTIAC. WITH LUXURY THAT DOESN'T IMPEDE YOUR SENSE OF ROAD AND A VERY ROBUST, AWARD-WINNING ENGINE UNDER ITS HOOD, THIS BOLD SEDAN IS BURYING EVERY PRECONCEPTION OF WHAT A LUXURY CAR HAS ALWAYS BEEN.



BONNEVILLE
LUXURY WITH ATTITUDE.

Copyrighted material

CALL 800-BONNEVILLE CRUISE WWW.PONTIAC.COM

PONTIAC
DRIVING EXCITEMENT.

Copyrighted material

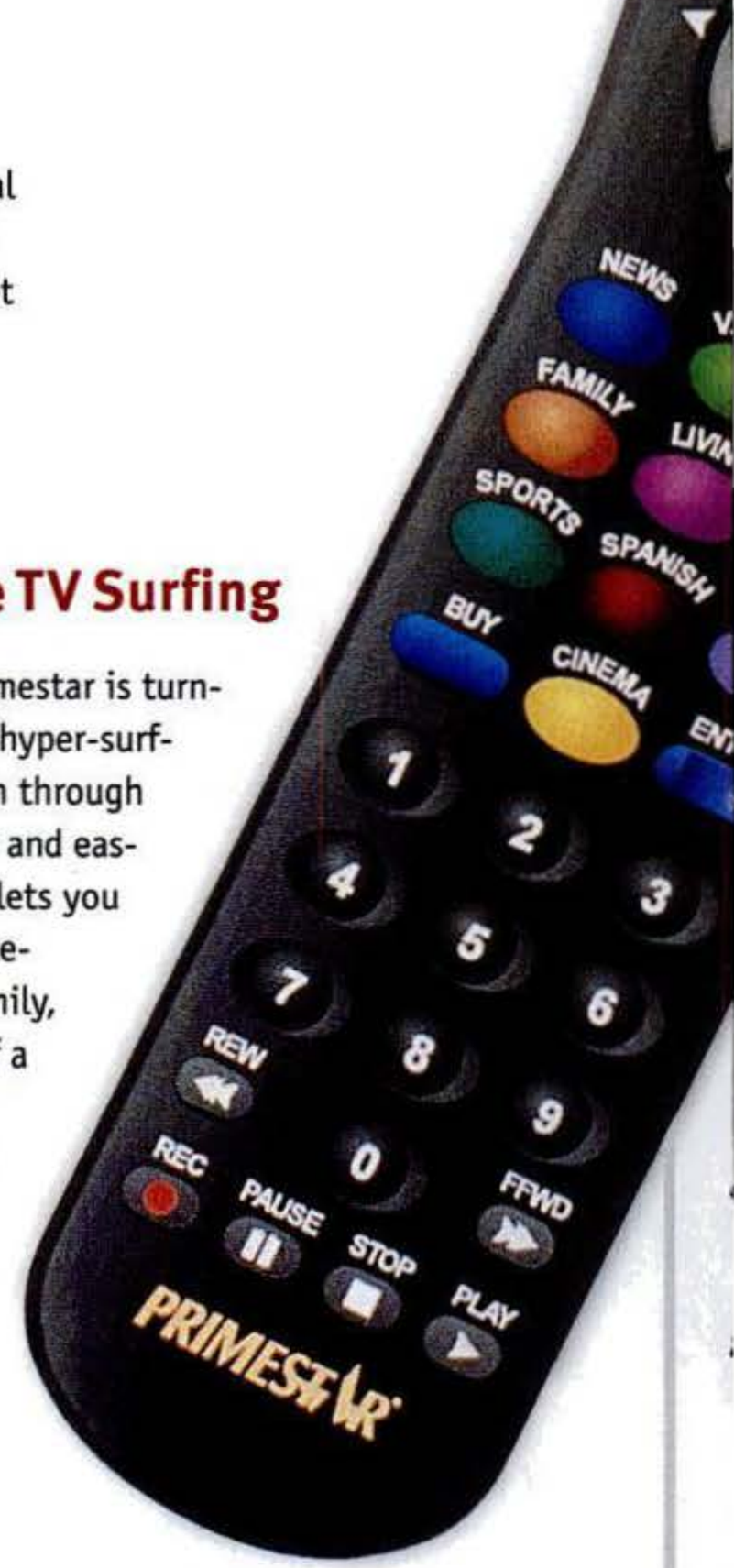
WHAT'S NEW

EDITED BY SUZANNE KANTRA KIRSCHNER

Research by Kevin Miller

Palm-Size Security

THE SPEEDDOME Ultra security camera measures a mere 4.7 inches in diameter, pans 360 degrees, and features a 48x digital zoom lens. Automatic backlighting compensation, vertical and horizontal edge enhancement, and a no-light-loss lens cover let the camera see better in the dark. Price: $2,995. Sensormatic Electronics, 951 Yamato Rd., Boca Raton FL 33431.



Satellite TV Surfing

SATELLITE TV provider Primestar is turning channel surfing into "hyper-surfing" by making navigation through its program lineup quicker and easier. A new remote control lets you access channels by 10 categories—such as news, family, or music—at the touch of a color-coded button. The extra convenience comes as Primestar upgrades from 95 to 160 channels.

Artful Scientist

THE POWER OF Leonardo da Vinci's artistic masterpieces remains undiminished through the ages. But as a true Renaissance man, he was also a gifted scientific observer and inventor. "Leonardo da Vinci: Scientist, Inventor, Artist," a new exhibit, covers the multifaceted artist's work via multimedia stations, displays, and models such as this paddleboat built from a drawing. Museum of Science, Science Park, Boston MA 02114-1099. *www.mos.org*

Bomb Disposer

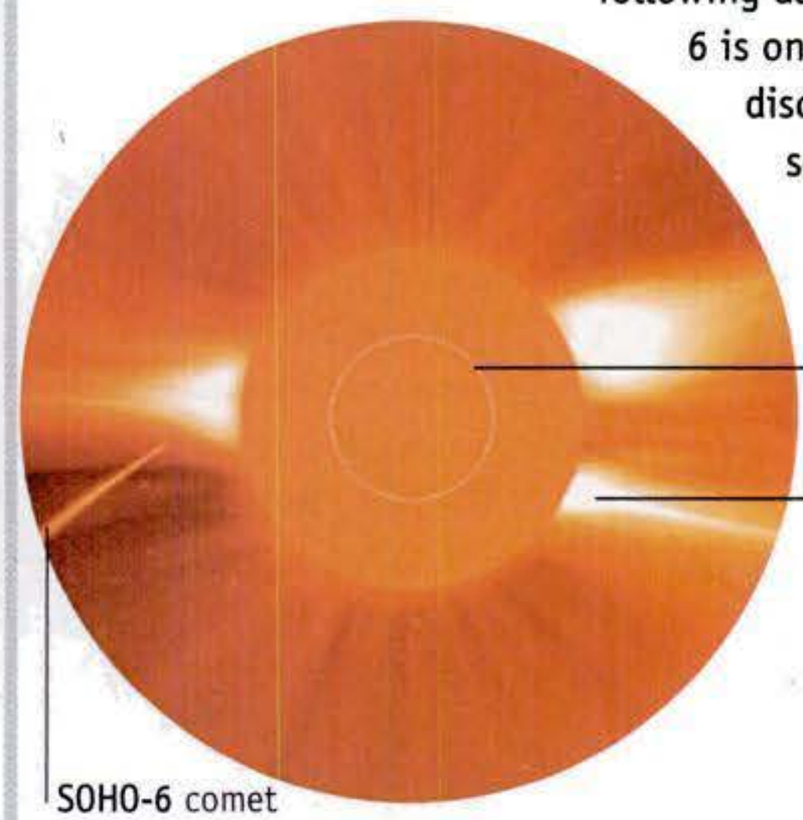
BEHAVIOR PROGRAMMING, a robot-control paradigm developed by robotics pioneer Rodney Brooks, enables a group of Fetch robots to clear a battlefield of cluster bombs virtually autonomously. Each Fetch is programmed with task-achieving behaviors that run simultaneously; conflicts are settled by an arbitration feature that gives one task priority over the others. If a Fetch gets into trouble, it can signal an operator for instructions. IS Robotics, 22 McGrath Hwy., Sommerville MA 02143. *www.isr.com*

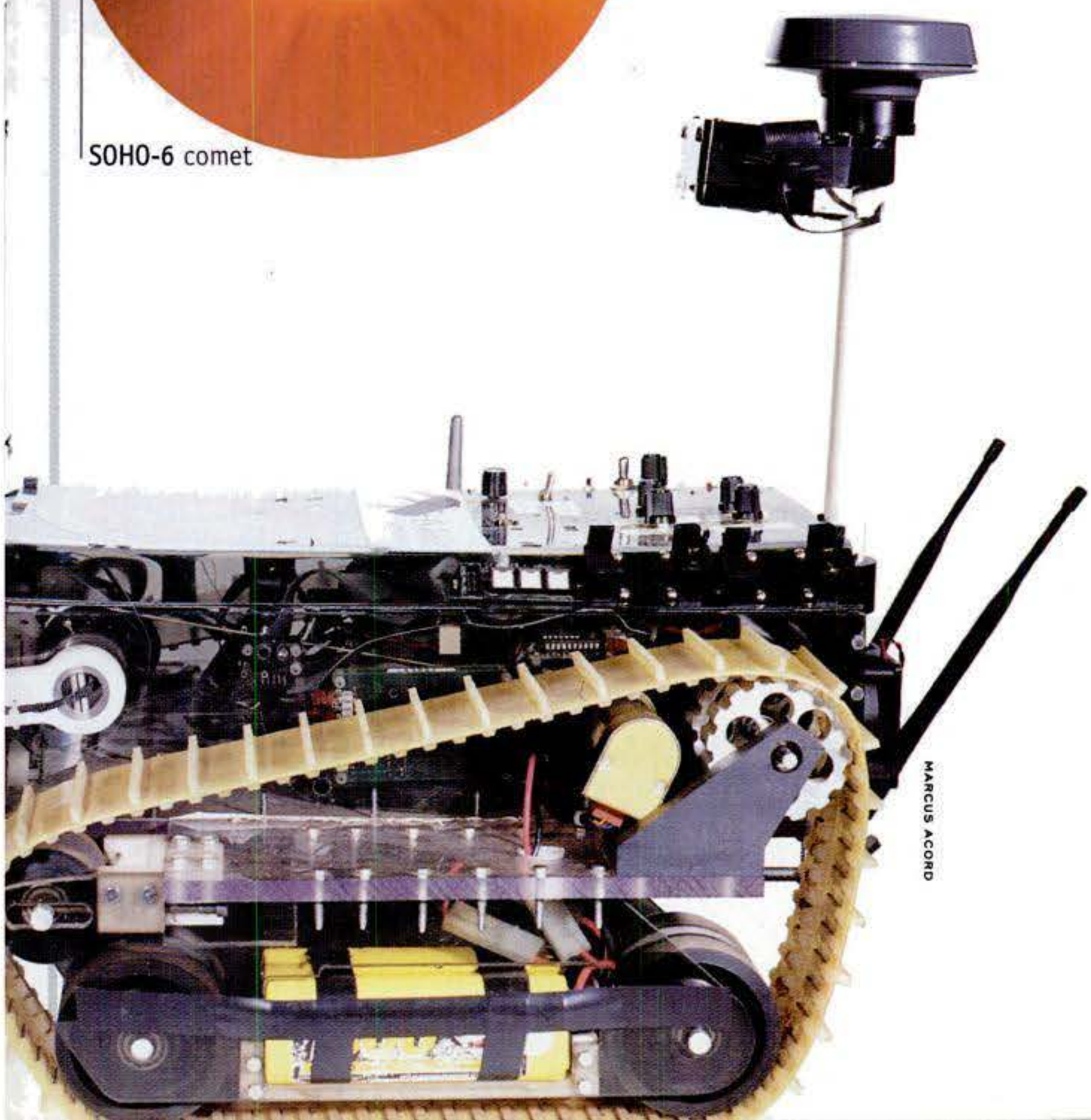
Power-Packed Camaro

THE 1998 CAMARO Z28 and SS models pack a 1997 Corvette LS1 V8 engine that delivers 310 horsepower and 335 foot-pounds of torque. The front end has been redesigned to improve its aerodynamics; new headlamps have reflector optics for greater nighttime visibility. Available this fall.

Sungrazer

MOVIES TAKEN BY a coronograph in solar orbit aboard the Solar and Heliospheric Observatory, or SOHO, show comet SOHO-6 being "swallowed" by the sun. The doomed object was seen heading toward the sun on December 22, 1996. The following day, it disappeared. SOHO-6 is one of seven "sungrazers" discovered so far by the observatory, a joint project of the European Space Agency and NASA.





MARCUS ACORD

Advanced SLR

PROFESSIONALS EXPECT peerless quality from Leica. And that's what they'll get from the R8, the first completely new Leica SLR since 1974. It's the most sophisticated, electronically advanced, and fastest of any Leica SLR, with a $^{1}/_{8,000}$th second top shutter speed. The R8 also has six-segment multi-patterned metering to cope with difficult lighting situations. Price: $2,995. Leica Camera, 156 Ludlow Ave., Northvale NJ 07647.

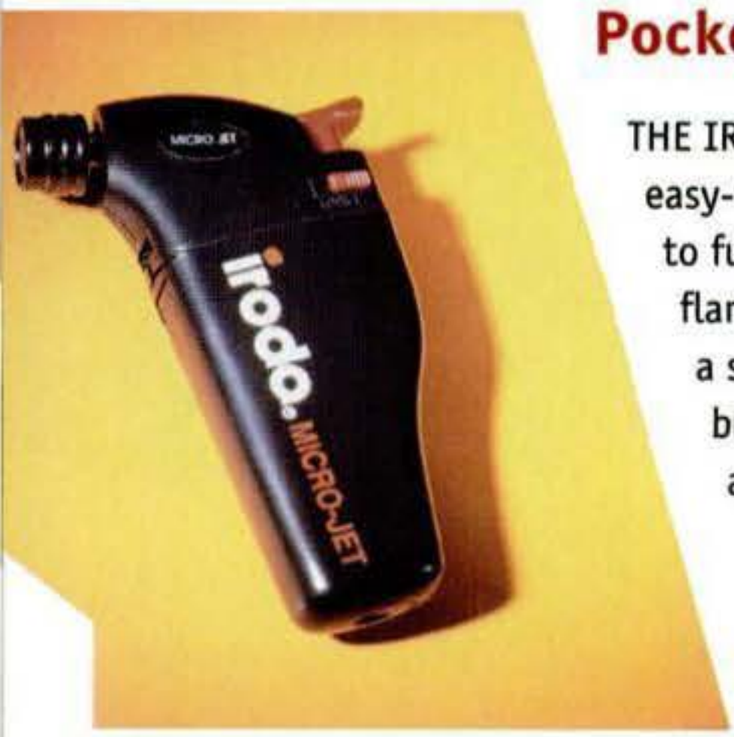
Copyrighted material

Limited-Edition Apple

FOR COMPUTER lovers with a collector's spirit, there's Apple's limited edition 20th Anniversary Macintosh computer. In addition to its radical look, the $9,000 computer sports a 250MHz Power PC 603e RISC processor; a Bose sound system with subwoofer; TV and FM tuners; a two-gigabyte hard drive; a vertically mounted CD-ROM drive; and a 12.1-inch SVGA active-matrix display. Apple Computer, 1 Infinite Loop, Cupertino CA 95014. *www.apple.com*

Robo 'Copter

THE FREE-FLIGHT Rotorcraft Research Vehicle—an experimental remote-controlled robot helicopter devised by NASA and the U.S. Army—can go wherever there's danger. About six feet long and able to hit 60 mph, the craft could assist in border patrols, fire surveillance, emergency medical delivery, and even precision crop spraying.



Pocket Torch

THE IRODA MICRO Jet Torch uses easy-to-find disposable lighters to fuel a safe high-temperature flame. The $23 device features a safety lock for the ignition button. One lighter produces a 2,500°F flame for 25 minutes. Zeraldo Marketing & Merchandising, 15156 Argyll Rd., Georgetown, Ontario L7G 5J2 Canada.

Coolin' Down

FEELING HOT? Cool down with a fine-mist spray, wherever you go. The Misty Mate Pump provides up to two hours of use from one pint of water, and the bottle fits snugly into a bicycle water-bottle holder. A hand pump pressurizes the canister and a valve turns the spray on and off. Price: $40.

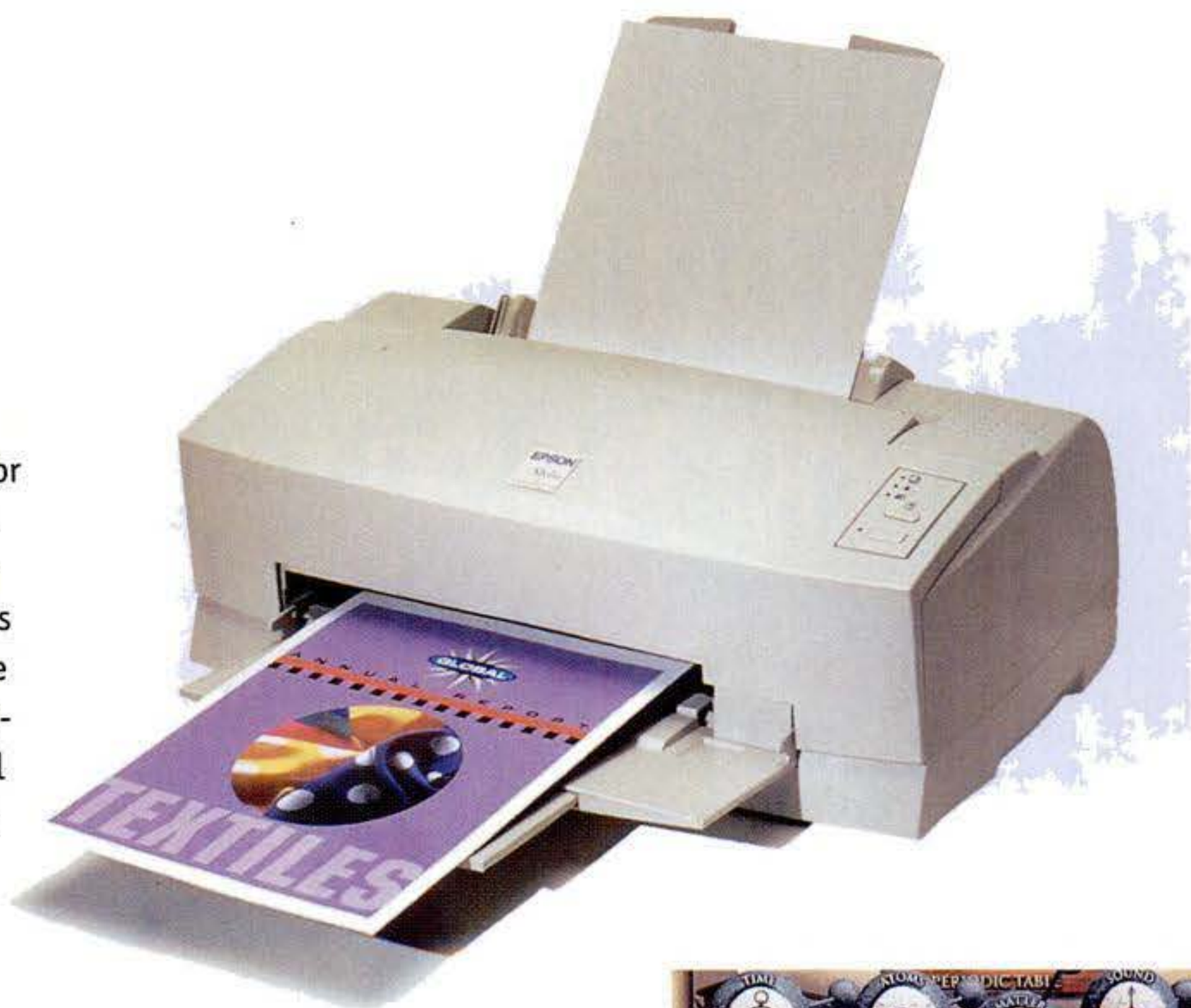
Wet Stopper

FIRESTONE'S FT70C all-season radial tire excels in stopping *and* handling on wet roads. To maintain wet-weather performance, the tire's keyhole-shaped sipes, or tread grooves, enlarge instead of decrease as the tire wears. Price: $55 to $100 each, depending on size. Bridgestone/Firestone, 50 Century Blvd., Nashville TN 37214-8900. *www.bridgestone-firestone.com*

"She's sort of wrinkled and scowls a lot. She hasn't stopped screaming since the day she arrived. The dogs are *terrified*."

Detail Sanding

WITH ITS DIAMOND-SHAPED sanding pad and assortment of shaped contours, the 1.75-pound Dremel Contour Sander takes the tedium out of hand-sanding nooks, crannies, and odd shapes. It features variable speed (4,000 to 8,500 strokes per minute) and a quick release, for easy accessory changing. Price: $80. Dremel, 4915 21st St., Racine WI 53406-9989. *www.dremel.com*



More Dots for the Money

EPSON'S STYLUS Color 800 breaks ground for inkjet printers with its 1,440-by-720-dots-per-inch resolution in both black and color output. Epson says the jump in resolution is due to its use of electromechanical pressure to accurately place ink on the paper. The result is photo-quality output without special "photo" inks. The Color 800 works with PCs and Macs. Price: $450. *www.epson.com*

Ratchet-Action Wrench

THE DISTINCTIVE jaw geometry of Primatronic's 40R fast-action double-ended wrench enables free rotation one way and automatic locking onto the flat sides of the nut in the other direction. For extra gripping power, the wrench locks onto three separate sides of the six-sided nut. Made in 17 sizes, from 8- to 24mm, the wrenches cost $8.50 to $29. Primatronic, 4 Omega Center, Stratton Business Park, Biggleswade, Beds SG18 8QB England.

GREG MAXSON

Encyclopedic Knowledge

DK MULTIMEDIA'S Eyewitness Encyclopedia of Science, one of the best science resources on a disc, is back with more than 130 new screens and animations, and deeper discussions on physics, math, chemistry, and life sciences. Version 2.0 also features an expanded Who's Who section, and a new search function makes it easier to find what you're looking for. Price: $40, for PCs and Macs. *www.dk.com*

Copyrighted material

Without Intel's Video Phone, you could get the wrong impression about the new arrival.

Phone calls will never be the same. But then, neither will PCs. The Intel Pentium® processor with MMX™ technology, combined with a video phone, makes PCs more exciting and fun to use. Using an Intel Video Phone with ProShare® technology, which takes advantage of Intel MMX media enhancement technology, will give you smoother video right over your existing phone lines.*

Talking PC-to-PC feels more like talking face-to-face. To see a demonstration of Video Phone on a PC that has a Pentium processor with MMX technology, visit your computer retailer. And see what everyone's been talking about. ► www.intel.com

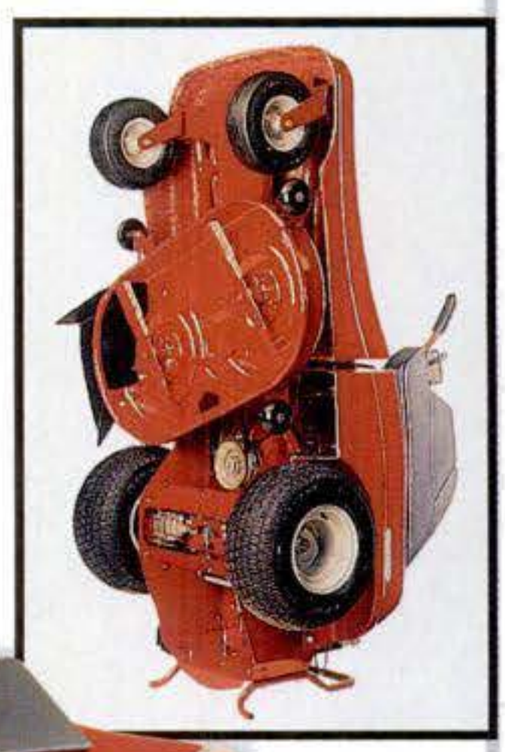
intel®

The Computer Inside.™

© 1997 Intel Corporation. *As compared to a Pentium® processor at same speed measured on Intel's Media Benchmark. Actual performance will depend on hardware and software configurations as well as the quality of the telephone connection. Simulated video phone image. Confirm with your PC manufacturer that Intel Video Phone software version supports Intel MMX™ technology.

Diminutive Digital

MEET THE smallest LCD digital camera. Measuring 28mm by 74mm by 102mm, the 185-gram Picona features a 1.8-inch LCD display. The camera can store 25 images on a tiny 2MB Compact Flash card. The camera runs on two AA batteries for a half hour. Available only in Japan.



Take a Cruise

IT'S A BIT OF A STRETCH to call mowing the lawn a chore when the mower you're using steers with a joystick and sports a beverage holder. Snapper's Yard Cruiser features a zero-turning radius for maneuvering in tight spots; a 14- or 15-horsepower engine; and a frame that stands on end for easier storage. Available with a 33-, 38-, or 42-inch deck. Prices start at $3,500. Snapper, 535 Macon Rd., McDonough GA 30253. *www.snapperinc.com*

Telescopic Glasses

FOR PEOPLE WITH severe visual impairments, researchers at the University of North Carolina-Chapel Hill have developed an autofocusing telescope-like system that works with eyeglasses. The Ocutech VES AutoFocus device's infrared continual-focus system enables the 4x-zoom lens to magnify objects from as close as 12 inches. The 2.5-ounce system costs $3,000. Ocutech Inc., Chapel Hill NC 27515.

Ecologically Minded Car

AN ASYMMETRICALLY turbocharged V6 EcoPower engine will debut next spring in Saab's 9-5. A single turbocharger is mounted on the front cylinder bank and driven by exhaust gases from that bank. This means the turbocharger can be integrated into the exhaust manifold. The result, says Saab, is an engine that uses less fuel and has cleaner exhaust. Saab Cars USA, 4405-A Saab Dr., Box 9000, Norcross GA 30091.

Copyrighted material

Europe's classic sports sedans – BMW 328i, Mercedes C280 and Volvo 850 turbo – wield incredible horsepower. The new Subaru 2.5 GT sports sedan, however, not only possesses plenty of horsepower, but amazing superpowers as well. Like the unbelievable traction of full-time All-Wheel Drive. The superior stability of a horizontally opposed engine. And the remarkably smooth ride of an optimally tuned suspension. Together they form the Subaru All-Wheel Driving System. A system that senses whatever dangers lurk ahead, automatically shifting power to the wheels that need it most. So you can hold your ground against a menacing cast of archenemies: rain, snow, sleet and gravel. The available 5-speed Subaru 2.5 GT also packs quite a punch, thanks to its powerful low-end torque. For the expanded version of this action figure's resume, just call 1-800-WANT-AWD, visit our website at http://www.subaru.com or, better yet, drop by your nearest Subaru dealer and take the amazing 2.5 GT for a test-drive. And in no time you'll find yourself doing things you never dreamed humanly possible.

The New 1997
SUBARU 2.5 GT

CLINGS TO A SURFACE SO WELL YOU'LL SWEAR YOU HAVE SUPERPOWERS.

SUBARU
The Beauty of All-Wheel Drive®

Copyrighted material

Luxury SUV

DESIGNED FOR luxury as well as power, the concept Yukon Denali sport utility features front and rear leather seats, two cellular phones, and a rear-seat entertainment center with audio controls, a drop-down TV, and a VCR. Under the hood, you'll find a 255-horsepower 5.7-liter V8.

Big Zoom, Small Body

CANON'S SURE SHOT 105 Zoom packs a 3x-zoom lens into a 2x-zoom-size body. The $300 camera features a 38-105mm f/3.8-9.9 lens, three-point autofocus, and an easy-to-use, oversize mode dial. Canon U.S.A., One Canon Plaza, Lake Success NY 11042.

Hedge Up

IT'S ALL TOO easy to cut the electrical cord accidentally when using a hedge trimmer. That's why battery power makes sense. Black & Decker's CHT600 cordless trimmer is equipped with a 12-volt nickel-cadmium battery, making it the most powerful available. Its 16-inch blade slices through branches as thick as 3/8 of an inch. Weighing just over five pounds, the trimmer sells for about $100.

Pre-Packed Pack Chair

TIRED OF LUGGING a chair and picnic basket to your favorite beach spot? With a padded chair built into the back of its KletterRest backpack, Crazy Creek neatly consolidates your beach gear. It comes in two sizes—1,500 or 2,150 cubic inches—and a variety of colors, including camouflage. Prices: $70 and $86, depending on size. Crazy Creek, Box 1050, Red Lodge MT 59068.

Copyrighted material

POWER TO THE PEOPLE

The Coleman Powermate 1000 Generator & Battery Booster.

850 Watts of Power, Only 22 lbs.

Power that goes anywhere you go.

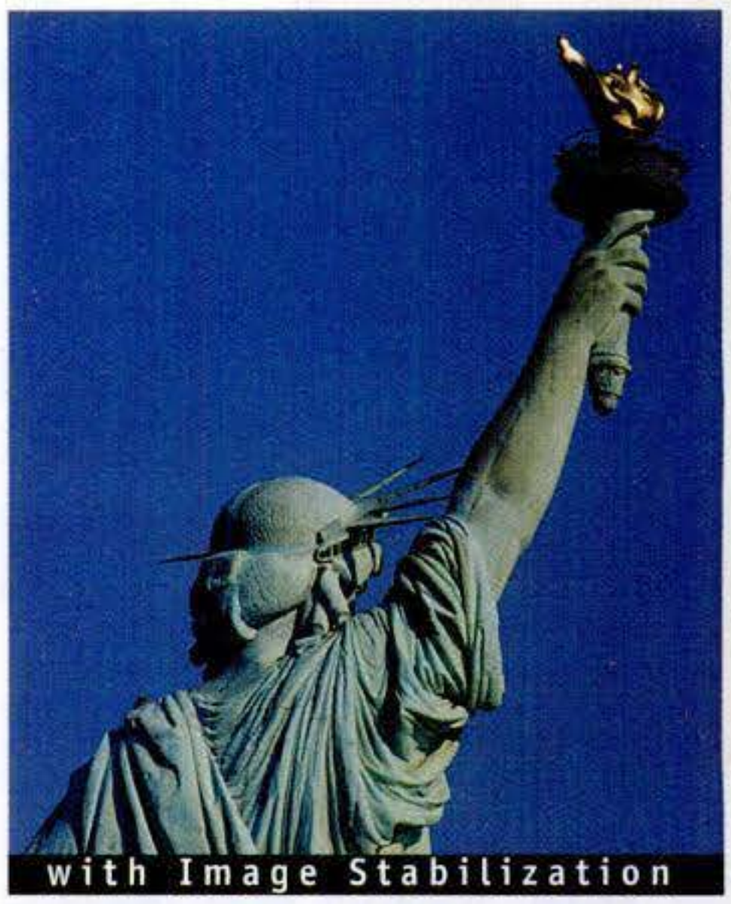
©1997 Coleman Powermate, Inc.

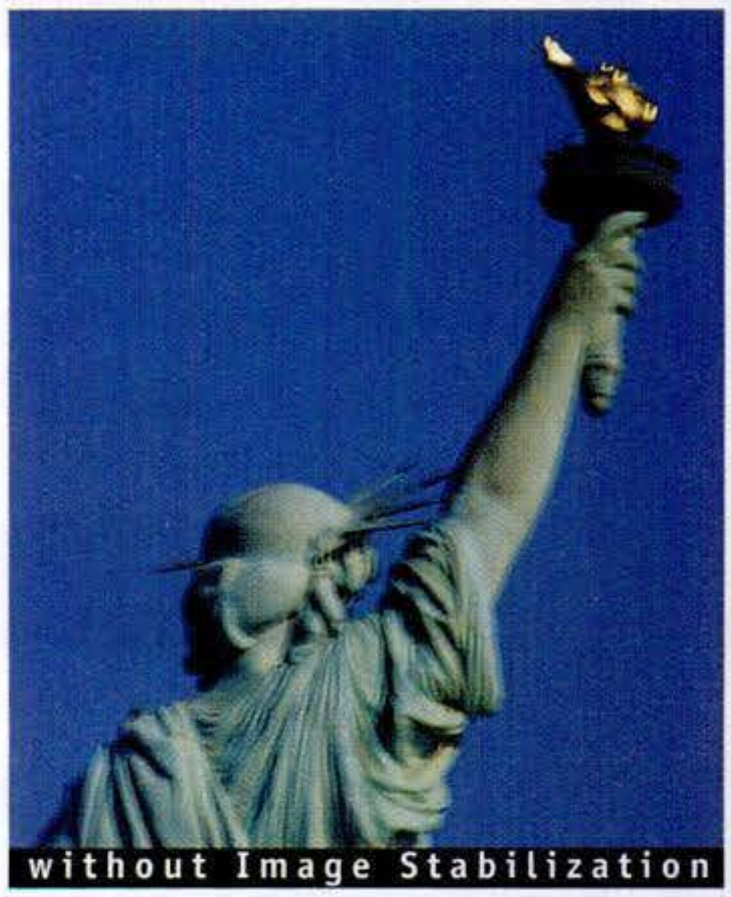
CALL 1-800-445-1805 FOR A STORE NEAR YOU.

Coleman **Powermate 1000**™

Copyrighted material

STABILITY





These photos of the Statue of Liberty demonstrate Image Stablilization technology. The shots were taken from a moving boat in choppy water. Image **Stabilization was turned on (top) and then turned off (bottom).**

Three new Canon products with Image Stabilization automatically steady the shakes and beat the blurs.

Anyone who carries a camera, camcorder or binoculars knows about "image shake," even if they've never heard the term. And they know what it does—magnifying even slight hand or camera movements to create blurred, jumpy images that can spoil once-in-a-lifetime scenes, photos or video images.

Until recently, the only practical way to reduce image shake was to use a tripod or other fixed mount, or to increase shutter speeds to "freeze" the image. Unfortunately, such compromises also affect the mobility, ability and creativity of the person holding the camera or binoculars.

A permanent solution to this problem arrived with the introduction of Image Stabilization (IS) technology from Canon. This microprocessor-controlled system was developed by Canon to counteract unwanted motion and image shake in camcorders. The technology was soon refined and miniaturized to a point where Image Stabilization could be adapted to single-lens reflex camera lenses and binoculars.

Now, Canon has advanced this revolutionary concept to an even higher level with the addition of Image Stabilization in its EF 300mm f/4 IS USM super-telephoto lens, in its new ES970 22X 8mm Camcorder, and in its new high-power 15X45 IS Binoculars. Only Canon offers Image Stabilization in all three product categories.

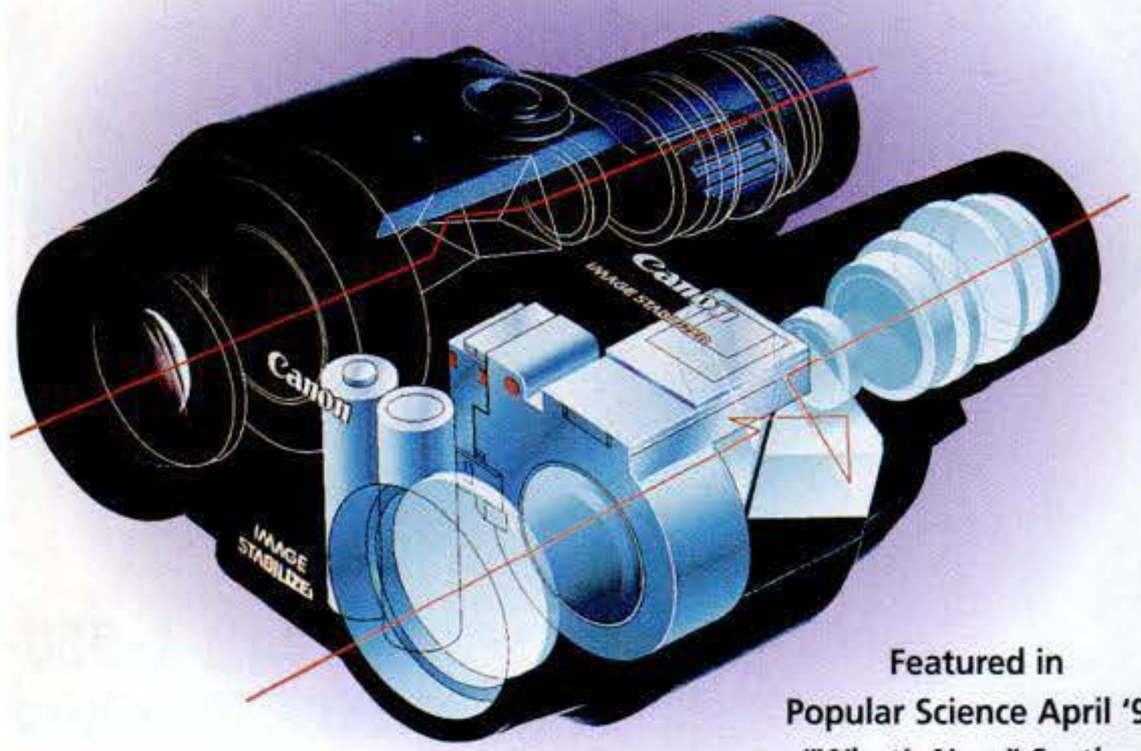
lens

The Compensative Optical System in Canon's new **EF 300mm f/4 IS USM super-telephoto** lens offers two Image Stabilization modes for still photos and panning shots.

Featured in Popular Science April '97 "What's New" Section.

binoculars

A unique Vari-Angle Prism System in Canon's new high-power **15X45 IS Binoculars** maintains a steady image, eliminating unwanted motion, distortion and blurring.



Featured in Popular Science April '97 "What's New" Section.

Copyrighted material

Continuous Correction

There are actually two forms of Image Stabilization developed by Canon. The first is the Vari-Angle Prism system. Originally created for Canon video products like the ES970 Camcorder, this system is also available now in both the 12X36 IS and new 15X45 IS Binoculars.

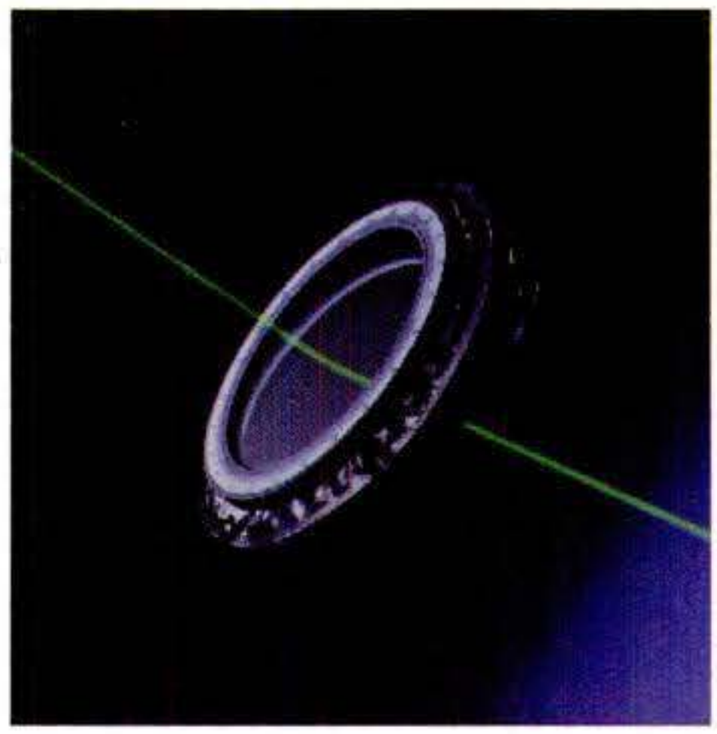
In the camcorder and binocular IS system, independent vertical and horizontal sensors detect conflicting movement or vibration and transmit this information to a microprocessor. Corrective signals are then sent to drive actuators which instantly shift the Vari-Angle Prism to compensate, and continuously adjust the shape of the prism to maintain a steady image.

Before Image Stabilization, 7X or 8X was considered the maximum magnification suitable for hand-held binoculars. Canon's 12X36 IS binoculars changed this view forever, and the 15X45 IS sets a new, high-performance standard. The Vari-Angle Prism system also helps to eliminate the jittery, unrecognizable images that typically plague camcorder videotapes.

Vari-Angle Prism System

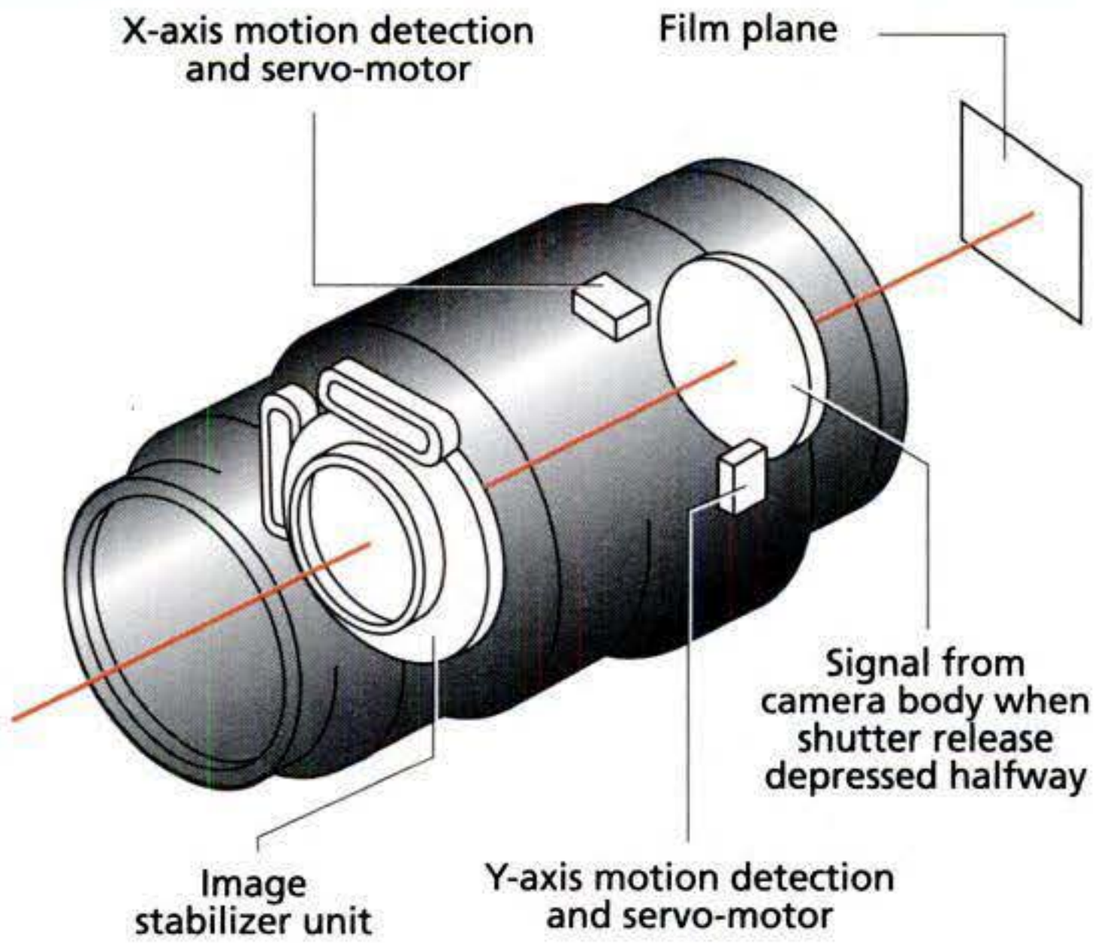
15X45 IS Binoculars and ES970 22X 8mm Camcorder

The Vari-Angle Prism is a sealed bellows composed of two optical-glass plates joined by a super-flexible film and filled with a clear, high-refractive-index fluid. The prism's shape continuously adjusts to counteract image shake.



Compensative Optical System

EF 300mm f/4 IS USM camera lens



A Compensating Lens

The second form of IS technology is the Compensative Optical System, available in Canon's EF 300mm f/4 IS USM super-telephoto camera lens. Controlled by a 16-bit microcomputer, this system employs X- and Y-axis motion detectors to monitor sudden camera movements, and servo-motors that instantly shift one of the lens groups to compensate. This IS system effectively reduces shutter speeds by two stops, providing incredibly sharp pictures at speeds as slow as 1/60th of a second. When shooting in poor light, this could mean the difference between increasing shutter speed or sacrificing critical depth of field.

Enhanced Dual Mode

The EF 300mm f/4 IS USM super-telephoto lens also lets you switch between standard Image Stabilization and a panning IS mode. When panning, the system intelligently stabilizes the image in the direction perpendicular to the camera's movement.

In both systems, Canon Image Stabilization allows camera and binocular users to capture the images they want by eliminating factors that were once—but no longer—beyond their control.

camcorder

Image Stabilization is also available in Canon's new **ES970 22X 8mm Camcorder**, with the world's longest optical zoom camcorder lens.

For more information, call 1-800-OK-CANON, or visit the Canon website at http://www.usa.canon.com.

Canon

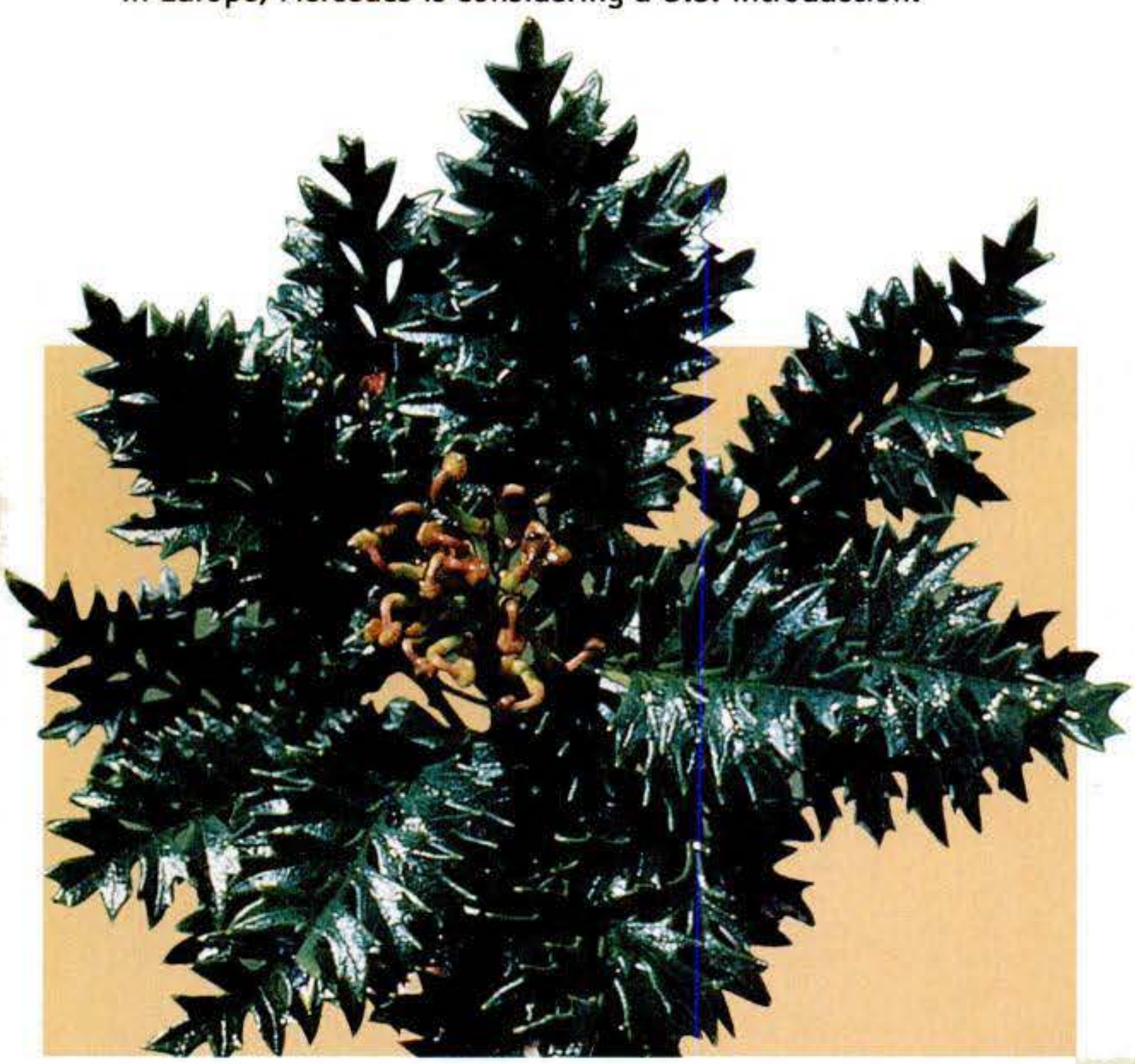
Copyrighted material

Neck-Pain Relief

THE MEDIFLOW WATER-BASED PILLOW relieves chronic neck pain during sleep or rest, according to a recent Johns Hopkins study. A thin water-filled bag in the pillow conforms to neck and head positions during sleep, providing continual neck-muscle support. Price: $50. Mediflow Inc., 11-130 Konrad Crescent, Markham, Ontario, L3R 0G5 Canada. *www.mediflow.com*

Mini Mercedes

MERCEDES-BENZ INVADES minicar territory with its 11.7-foot-long A-Class "city car." The five-seat hatchback has an innovative double-floor body that houses the engine and front-drive transaxle inclined under the front seats, and the manifold assembly and fuel system upright under the hood. In a front crash, the engine is shunted beneath the passengers, while the softer components in the nose help absorb the impact. There are also four all-new four-cylinder engines. The car is being sold in Europe; Mercedes is considering a U.S. introduction.



A Stone Age Plant

SCIENTISTS IN Tasmania have discovered the world's oldest living individual plant. Fossils of the *Lomatia tasmanica*, or King's Holly, dating back 43,000 years, were found near the plant's only known location, Southwest Tasmania, Australia. The plant reproduces asexually, by cloning itself, which suggests that today's existing plants are genetic replicas of the Stone Age fossils. *www.parks.tas.gov.au*

Home PC with DVD

TOSHIBA'S INFINIA 7220 is the first home computer to feature a built-in DVD-ROM drive. The 200MHz Pentium MMX system also comes with MPEG-2 video hardware, Dolby Digital audio, and 3-D graphics, as well as another new wrinkle: a pair of Universal Serial Bus (USB) ports for connecting multiple peripherals to each. *computers.toshiba.com*

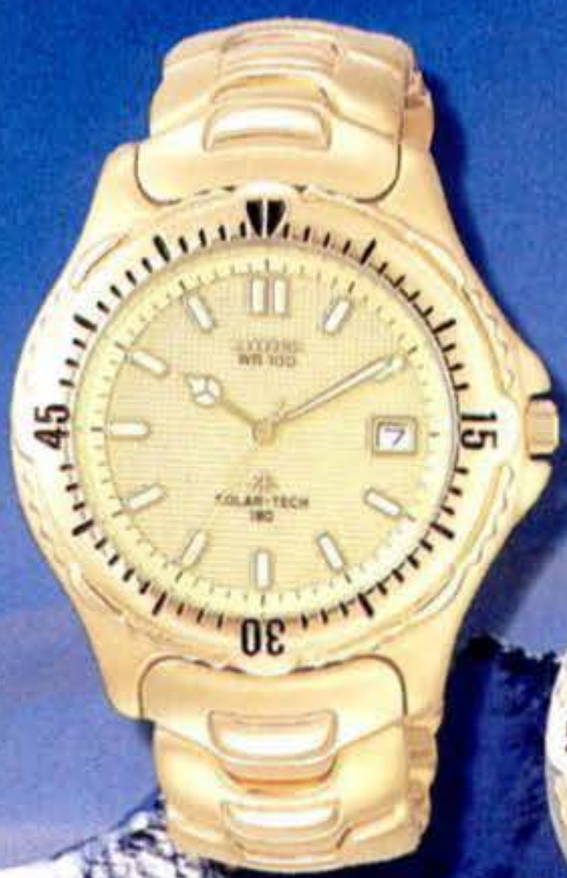
CITIZEN® HOW THE WORLD TELLS TIME.

CITIZEN® HOW THE WORLD TELLS TIME.

Solar-Tech Chronograph. With alarm, plus countdown timer. One-way rotating bezel. 100 meter water-resistant.

Solar-Tech Elite

World class Eco-Drive technology in an amazingly thin dress watch. It's always ready for the next business trip or weekend of sports. Peak performance guaranteed.



Solar-Tech 180 Sport. Stainless steel bracelet. Date calendar. One-way rotating bezel. 100 meter water-resistant.

All Citizen watches are covered by a 5-year warranty.

http://www.citizenwatch.com

CITIZEN watches can be purchased in the:

United States

SEARS

Canada

PEOPLES JEWELLERS

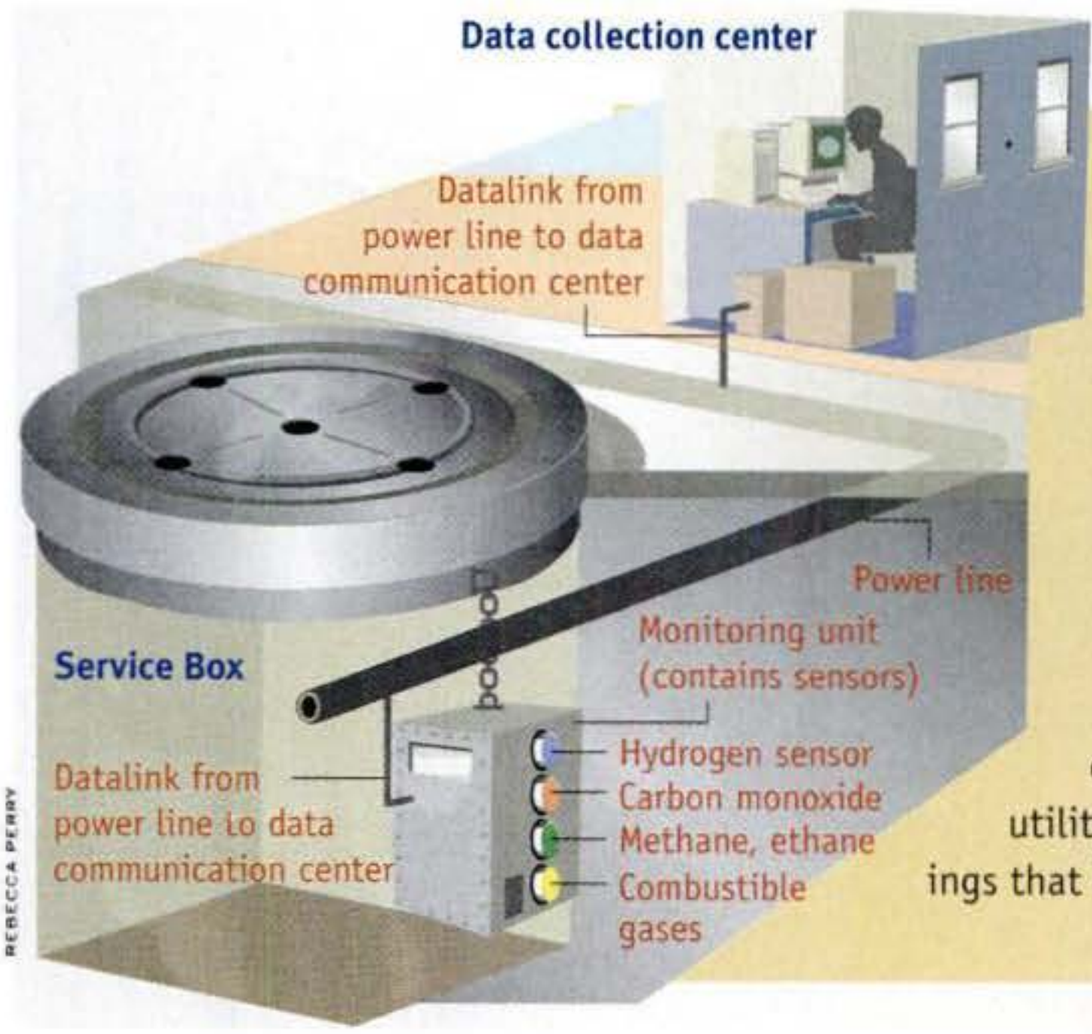
Caribbean

COLOMBIAN EMERALDS INT'L

Copyrighted material

Self-Hiding Stereo

THE FACEPLATES ON Kenwood's "Mask" car stereos rotate to hide their presence from thieves. The faceplate rotates down for inserting a CD or cassette, leaving more room for a larger, easier-to-read display. Price for cassette players: $330 to $450; CD players: $380 to $550. Kenwood USA, Box 22745, Long Beach CA 90801.



REBECCA PERRY

Manhole Gas Sensor

TO PREVENT dangerous manhole explosions, which can hurl 300-pound covers skyward, the Carnegie Mellon Research Institute has developed a prototype sensor that detects the accumulation of combustible gases in underground utility vaults. The monitors sample the tunnel air once a minute and instantly alert utility company personnel of any readings that indicate a potential explosion.

Shattering the Speed Limit

SUPERMAN, BILLED as the world's tallest, fastest roller coaster, opens this summer at Six Flags Magic Mountain in Valencia, California. A combination of linear motors and magnets propels the 15-passenger cars along a horizontal track. After an initial rise, the cars reach speeds as fast as 100 mph; the track then takes a sharp vertical turn, rising 415 feet. At the peak, the cars reverse and free-fall back down the track.

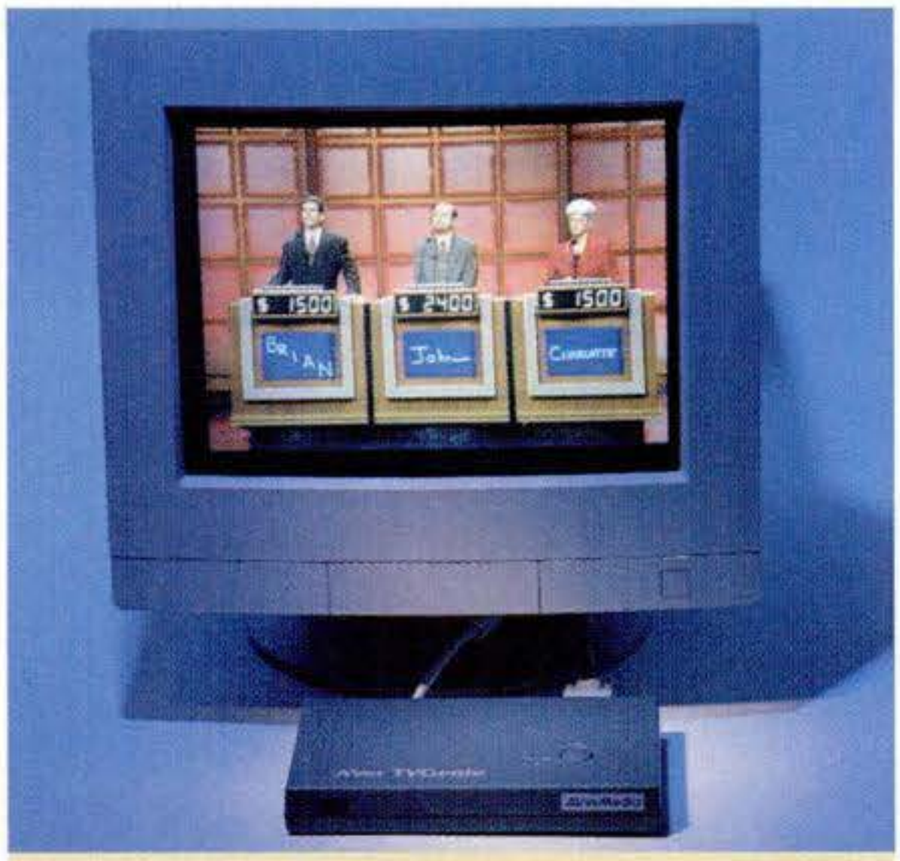
Miniature Motor

WITH THE DEBUT OF ITS 22cc GX22 and 31cc GX31 engines, Honda becomes the second manufacturer to offer four-stroke engines designed specifically for outdoor power equipment. Four-stroke engines produce fewer emissions than the more common two-stroke engines. A distinctive lubrication system enables the engines to run while tilted at any angle. First application: a string trimmer available this summer.

Copyrighted material

Tiburon Goes Topless

TAKE HYUNDAI'S Tiburon coupe, add a retractable top, and voila! You have the company's convertible concept car. The idea? To add another level of sportiness to an already sporty car. The roadster has a 2.0-liter 4-cylinder engine that develops 140 horsepower.



Hassle-Free PC TV

YOUR PC MONITOR can be a TV with the TV-Genie external signal converter. The $149 device sits between your computer and your monitor, eliminating complicated hardware installations. TVGenie features a pass-through port for your computer; RCA jacks for your VCR, stereo, or game system; a cable jack; and remote control. AVerMedia, 47923A Warm Springs Blvd., Fremont CA 94538. *www.aver.com/aver*

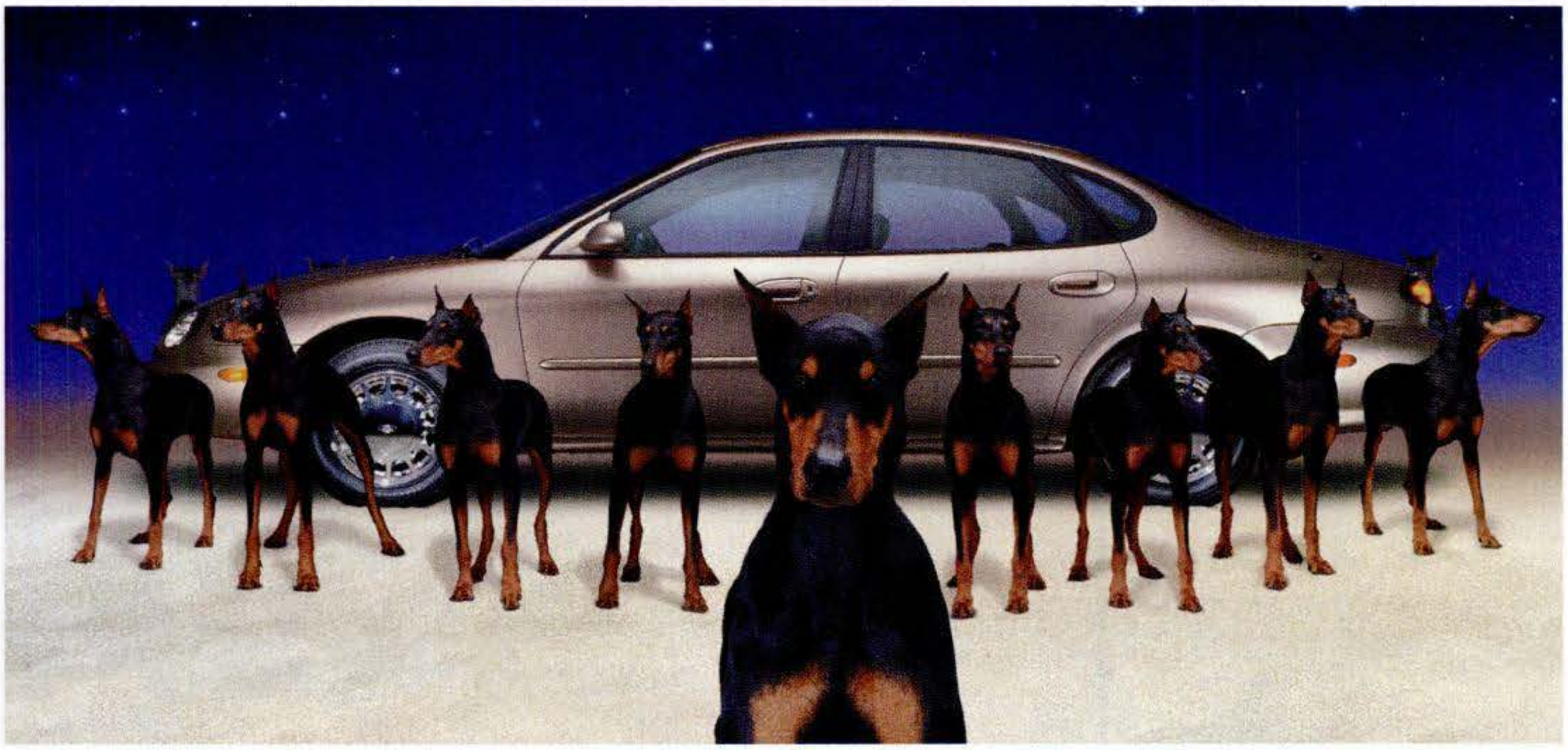
Robot Roves on Its Own

HONDA researchers say their humanoid robot is the first capable of controlling its own movements in response to surrounding terrain. The six-foot 462-pound prototype can climb stairs and steep slopes. This type of robot might eventually work in danger zones or assist the elderly and handicapped. Honda Motor Co. Ltd., 1-1, 2-chome, Minami-aoyama, Minato-ku, Tokyo 107, Japan.

Dry Cleaner for Streets

UNLIKE THE WET-THEN-SWEEP METHOD used by other mechanical street cleaners, Enviro Whirl's Particulate Management equipment uses no water. Paired with a distinctive broom head that whisks up debris, its air filtration system controls surface dust. By eliminating cleaning fluids, this equipment also reduces storm-water runoff that can contaminate ground water. Enviro Whirl Technologies, 2338 Calumet St., Centralia IL 62801.

A SIMPLE YET ACCURATE DEMONSTRATION OF HOW OUR ANTI-THEFT KEY WORKS.



Finally, there's a CAR PROTECTION device whose bite is worse than its bark. Ford Motor Company engineers have developed what's being hailed as one of the most powerful ANTI-THEFT inventions ever. A remarkable computer chip that's embedded in the key. This chip sends a distinct ELECTRONIC SIGNAL directly to the car's engine before it will ever start. You see, at FORD MOTOR COMPANY, we're not only committed to building the best quality cars and trucks in the WORLD but also to making absolutely sure our CUSTOMERS keep them. Because we believe your car should always be there for you. Like a best friend.

· FORD · FORD TRUCKS · Ford · LINCOLN · MERCURY ·

QUALITY IS JOB 1.SM

Available on select Ford, Lincoln and Mercury products. For more information, contact us on the Internet at: http://www.ford.com

Copyrighted material

1 How can the whole world breathe easier?

2 With the world's first CFC-free inhaler. CFCs help deliver vital medicine, but harm the world's ozone layer. Now 3M Pharmaceuticals has discovered how to make metered-dose inhalers without them. And we're working in partnership with other pharmaceutical companies, so together, we can begin to replace the 440 million inhalers used each year. This breakthrough–along with the first metered-dose and breath-actuated inhalers–shows a commitment to leadership that's built one of the world's largest health care companies. And helps us make the leap *from need to...*

3M *Innovation*

Copyrighted material

NEWSFRONTS

COMPUTERS & SOFTWARE

EDITED BY CHRIS O'MALLEY

DIGITAL CAMERAS

Pocket Shooters

WHAT'S THE WORD in digital cameras these days? Apparently, the word is "small," as in ever tinier electronic picture takers.

Several big names have joined the digital downsizing. Panasonic's PV-DC1000 "PalmCam" ($499) lives up, or down, to its nickname, fitting easily in the palm of your hand. Yet it has the same 1.8-inch color LCD screen that many larger cameras have, and can hold as many as 32 pictures at a VGA resolution of 640 by 480 pixels. It also comes with a clever docking station that you can keep cabled to a TV or PC.

Canon's PowerShot 350 ($699), little brother to the PowerShot 600, packs an equally impressive set of features into its small, squarish frame. It can capture as many as 47 images in VGA resolution, and it has the same color LCD. But the 350's LCD tilts upward 40 degrees to help you preview or play back your pictures in variable lighting conditions. Next up in the size war: NEC's shirt-pocket-size Picona, which is available only in Japan and Europe for now. [See What's New, this issue.] All three cameras use matchbook-size flash memory cards to store their pictures.

Not everyone is following form. Konica's digital Q-EZ ($399) takes on the more familiar size and shape of a 35mm camera, for example, while Kodak's new DC120 is nearly camcorder-esque in size. But the DC120 has a 1,280-by-960 resolution and a 3x zoom lens.—*C.O.*

JOHN B. CARNETT

The new digital cameras from (top to bottom) Panasonic, Canon, Konica, and Kodak pack more pixels in smaller packages.

INTERNET

Movies via Modem

WHAT MANY consider the ultimate movie Web site recently added (what else?) movies. The American Film Institute (AFI) launched AFI OnLine Cinema (*www.afionline.org/cinema*) with the Internet premiere of the 80-year-old Charlie Chaplin classic, *The Rink*. And if you dialed the site up, you saw not only the movie in its entirety, but a significant step toward digital-quality movies on demand.

Chaplin goes digital, thanks to video streaming.

The Internet broadcast series is made possible by VDOLive technology from VDOnet Corp. (*www.vdo.net*). Using a play-as-you-download technique called video streaming, the movies come across your screen without waiting for files to be completely downloaded. The downside: You can't replay the downloaded data.

At the heart of the breakthrough technology is a sophisticated data-compression scheme that reduces the redundancy of visual images while creating a stream of data that can play in real time over relatively narrow bandwidths. The clips can be played on PCs or Macs, with as little as 8MB of memory, though optimum performance comes with Pentium or Power Mac systems boasting more muscle.—*Henry R. Schlesinger*

Copyrighted material

SMIRNOFF® VODKA 40, 45.2 & 50% Alc. by Vol., distilled from premium grain
©1996 Ste. Pierre Smirnoff FLS (Division of Heublein, Inc.) Hartford, CT—Made in U.S.A.
SMIRNOFF
PURE FANTASY.
SMIRNOFF

WIN THE ULTIMATE BASEBALL EXPERIENCE!

PLAY BALL WITH THE PROS AT BASEBALL FANTASY CAMP IN FLORIDA.

You'll be coached by the stars and train at a big league facility — 5 days and 4 nights of living and learning the game under professional conditions. Uniforms, umpires, fans and your very own collector's card are all part of the Smirnoff Pure Fantasy Baseball experience.

Twenty-two winners will play with the pros!
Just complete the entry form below, and mail it to
SMIRNOFF PURE FANTASY BASEBALL SWEEPSTAKES,
P.O. Box 8579, New Milford, CT 06776-8579.
And get ready to take your place in the lineup!

OFFICIAL RULES—NO PURCHASE NECESSARY

1. Complete an official entry form, or on a plain 3½"x 5" paper, handprint your name, address, zip code, telephone number and the words **"SMIRNOFF PURE FANTASY BASEBALL SWEEPSTAKES"**. Enter as often as you wish, but each entry must be mailed separately to **SMIRNOFF PURE FANTASY BASEBALL SWEEPSTAKES**, P.O. Box 8579, New Milford, CT 06776-8579. All mail-in entries must be postmarked by July 23, 1997 and received by July 30, 1997. Mechanically reproduced entries submitted by mail are void.
2. **Grand Prize (22): A 5-day, 4-night trip for the winner to a Baseball Fantasy Camp in Florida. Includes roundtrip air transportation from a major airport nearest the winner's home, hotel accommodations, airport transfers in Florida, meals and uniforms. (Est. retail value $3,500). Winners will be selected in a random drawing from among all entries received. Drawing will be conducted by CCM, an independent judging organization whose decisions are final on all matters relating to this sweepstakes. Odds of winning are dependent upon the number of entries received. All prizes will be awarded and winners will be notified by mail. Limit one prize to an individual or household. Prizes are nontransferable and no substitutions are allowed. Sponsor and its agencies assume no responsibility or liability for damages, losses or injury resulting from acceptance or use of any prize. Taxes, if any, are the responsibility of the individual winners. Winners may be required to verify address or execute an affidavit of eligibility and release within 14 days of notification attempt or the prize will be forfeited and an alternate winner selected. Trip subject to availability and confirmation of reservations, and must be taken from February 1, 1998 through February 5, 1998. Certain restrictions may apply. Entry constitutes permission to use winners' names and likeness for promotional purposes without further compensation except where prohibited by law. No responsibility is assumed for lost, misdirected, illegible or late entries or mail.**
3. Sweepstakes open to residents of the U.S. who are 21 years of age or older as of March 16, 1997 , except employees and their families of Heublein, Inc., their wholesalers, distributors and retailers, TIMES MIRROR MAGAZINES, their affiliates, subsidiaries, advertising agencies. This offer is void in the states of UT and wherever else prohibited or restricted by national, state or any other governmental laws. Subject to all federal, state and local laws.
4. **For a list of winners, available after 10/15/97, send a stamped, self-addressed envelope to: SMIRNOFF PURE FANTASY BASEBALL WINNERS LIST, c/o CCM, 470 Park Avenue South, New York, NY 10016.**

PS

SMIRNOFF

I WANT TO PLAY BALL!

ENTER ME IN THE SMIRNOFF PURE FANTASY BASEBALL SWEEPSTAKES.

Name _____

Address _____

City _____ **State** _____ **Zip** _____

Telephone _____ **Age: 21–29** ____ **30–44** ____ **45–65** ____ **66+** ____

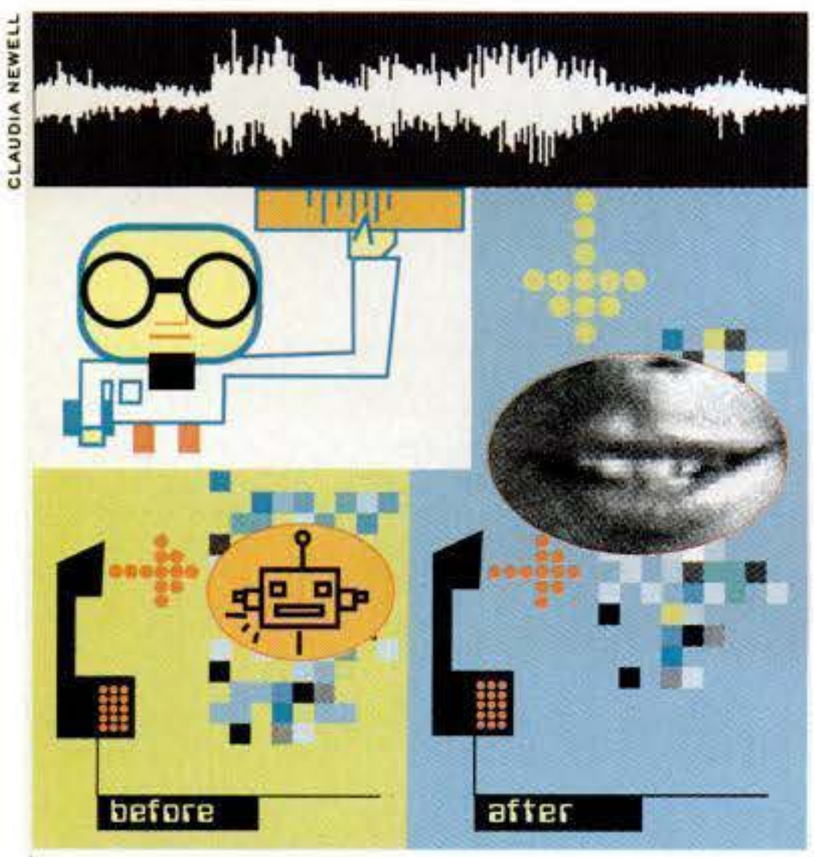
Send in to: The Smirnoff Baseball Sweepstakes, P.O. Box 8579, New Milford, CT 06776-8579

Copyrighted material

SPEECH RECOGNITION

Voice Lessons for PCs

TIRED OF COMPUTERS that sound like monotone robots when they talk to you? So are most of the people in the computer industry and their biggest customers, such as banks, airlines, and telephone companies. So now software giant Microsoft has engaged John Goldsmith, a University of Chicago linguist, to be a speech therapist of sorts for personal computers.



CLAUDIA NEWELL

Goldsmith is working on one half of a two-part Microsoft project. His aim: to write a program that will enable computers to speak in a way that is very close to the sound and rhythms of human utterances. While Goldsmith attempts that, Microsoft engineers will work on the other half of the project: teaching computers to recognize ordinary human speech. "Usually," says Goldsmith, "when computers sound good it's because someone recorded those words beforehand, and the computer is playing them back. But I want a human-sounding voice that is completely computer generated."

The problem is that although engineers have figured out how to create computer consonants and vowels, they have not yet achieved natural intonation. So linguist Goldsmith is writing a program that is able to figure out the natural "American English intonational pathways" for each sentence. His program connects to a Microsoft program that first analyzes the grammar of a sentence. Then it tells the computer's voice synthesizer what pitch and duration each syllable should be. The result is a computer that speaks English like a human.

Goldsmith's earlier work was the inspiration for AT&T's intonation system, used on its national telephone system. "When this is refined," he says, "It will totally revolutionize the computer industry."—*Arthur Fisher*

CD-ROM

Speeding the Disc

TIRED OF WAITING while your CD-ROM drive spins its discs? Western Digital thinks your hard disk can help do more to speed the process along.

The company says its new Storage Data Acceleration, or SDX, technology can improve CD-ROM performance by up to 100 percent by connecting the CD-ROM drive directly to the hard disk drive, rather than to an interface card or the PC's motherboard. This direct link enables the CD-ROM drive to temporarily store, or "cache," program instructions and data on the hard drive, which can transfer them to the processor and memory areas much more quickly.

The catch? You'll need new CD-ROM and hard disk drives to make this work. Western Digital plans to begin selling SDX hard drives this spring, which is about the same time Sanyo says it'll sell the first such CD-ROM drive. In all, more than a dozen companies say they'll support SDX. Western Digital says SDX can be adapted for DVD-ROM drives as well.—*C.O.*

INTERNET

The Next Net

THE NEXT GENERATION of the Internet is taking shape. Dubbed Internet II, it is being planned by U.S. universities as a new, superfast, national computer network that will avoid the traffic jams that frequently clog the Internet today.

Representatives from about 60 of the country's leading research universities are designing Internet II for a new class of applications that will far outstrip the present network's capabilities. Internet II will have speeds as much as 10 times as fast as today's Net. It's being developed primarily to give U.S. universities the kind of desktop-to-desktop broadband connections that can easily accommodate distance-learning presentations, videoconferencing, and online collaborative research, according to J. Gary Auguston, executive director of computer systems at Penn State and chairman of the national Internet II steering committee.

The first prototype of Internet II is a high-speed, high-bandwidth link on the campus of Penn State that runs between computer and engineering buildings. At 600 million bits per second—compare that to 28,800bps for a PC modem—it can dispatch an entire encyclopedia in 10 seconds. Nearly 3,000 undergraduate and graduate students in 15 different science and engineering courses are using two classrooms connected to the high-speed link to solve problems in fields such as fluid dynamics and chemistry.

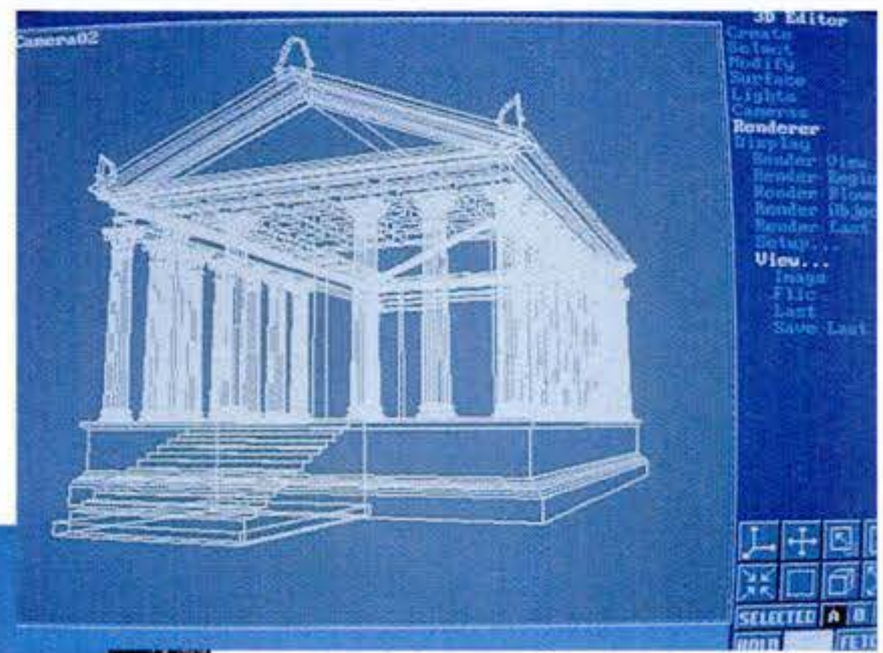
Beyond such disciplines, Internet II could be used in the arts. Theater classes, for example, could use it to design "virtual sets" for TV programs, with actors actually emoting in an empty room, adding scenery later.—*A.F.*

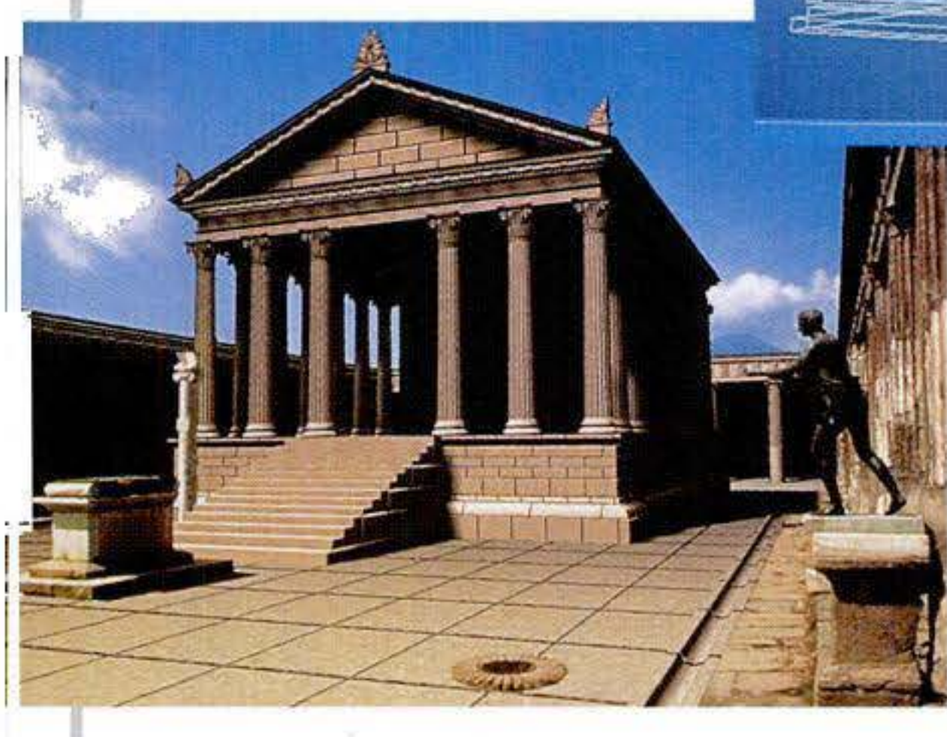
HANDS ON

Digital Digs

WHAT DID THE Parthenon really look like when it was brand new, some 2,300 years ago? Or the Forum Romanum after Julius Caesar redid it? Most of the glory that was Greece and the grandeur that was Rome, as well as the remains of other great civilizations, lies in ruins. Often, only shards are left to stimulate the viewer's imagination.

Now a collaboration among information technologists, computer experts, and students of ancient structures has spawned a discipline whose aim is to make archeological information visually real. The results are dramatically displayed in a new book called *Virtual Archeology: Recreating Ancient Worlds*, published by Abrams. The 660 full-color illustrations include computer-aided 3-D reconstructions paired with aerial photography of ancient sites, from the palace of King Minos on Crete to the dwellings of the mysterious Anasazi in the American Southwest, from an Emperor's tomb in Japan to the Aztec capitol of Tenochtitlan.





A virtual reconstruction of the Temple of Apollo is shown as a wireframe model and a completed computer graphic.

Before and after pictures—the "before" being contemporary photography and the "after" being the computer reconstruction—reveal how significant features have been lost with time. The triumph of this technique is to translate the information in archeological data banks into realistic and scientifically accurate images.—*A.F.*

EDUCATION

The Wrong Keyboard?

BUYING YOUR KIDS a computer to open their minds to the wonders of science and logic? Maybe you better buy a piano instead. A team of psychologists exploring the link between music and intelligence has found that piano instruction is far superior to computer instruction in enhancing the kind of abstract reasoning skills a child will need for excelling in math and science later on.

In a two-year experiment, one group of preschoolers was given private piano and singing lessons and another got private computer lessons. The musically trained kids scored 34 percent higher than the others on tests measuring the higher brain functions critical in science, math, and engineering.—*A.F.*

WEB WATCH

Our monthly Web filter
(Addresses preceded by http://)

The Car Center
www.intellichoice.com
Tips on buying and selling.

VolcanoWorld
volcano.und.nodak.edu
Jarring news, as it erupts.

ATM Locator
visa.infonow.net/usa.html
Money machines across the USA.

Race Shop
www.raceshop.com
Winston Cup news and fantasy leagues.

Access Energy
www.energy.ca.gov
Energy news from California.

Consumer Guide Best Buys
cg.gte.net/bestbuys
Reviews, from answering machines to wet-dry vacs.

In Search of the Giant Squid
seawifs.gsfc.nasa.gov/squid.html
Tales of the elusive giant squid.

Bicycle Transit Authority
www.bikeinfo.com
Leave your car at home.

Aviation Safety Data
nasdac.faa.gov/internet
Why some planes didn't fly.

Intl. Nuclear Safety Center
www.insc.anl.gov
How safe the power plants really are.

Worldtime
www.worldtime.com
Has the sun set on Tokyo?

Glacier
www.glacier.rice.edu
Exploring Antartica's land, weather, and oceans.

The Cyber Toaster Museum
www.spiritone.com/~ericn
A look back at electric toasters.

—*Suzanne Kantra Kirschner*

Copyrighted material

WE PUT THE VANITY MIRRORS ON THE OUTSIDE.

[PRESENTING THE CHEVY S-10 SPORTSIDE.]

As Johnny drove his Chevy™ S-10® Sportside™ deeper into no man's land, the sun shimmered along its curves. With its boldly styled fenders and intimidating beauty, it screamed for attention.

"The guys would kill for this truck," Johnny noted. "Like they'll ever see it," he said, riding into the sunset.

For more information visit www.chevrolet.com or call 1-800-950-2438.

©1996 GM Corp. Buckle up, America!

CHEVY S-10 LIKE A ROCK

Copyrighted material

SCIENCE & TECHNOLOGY

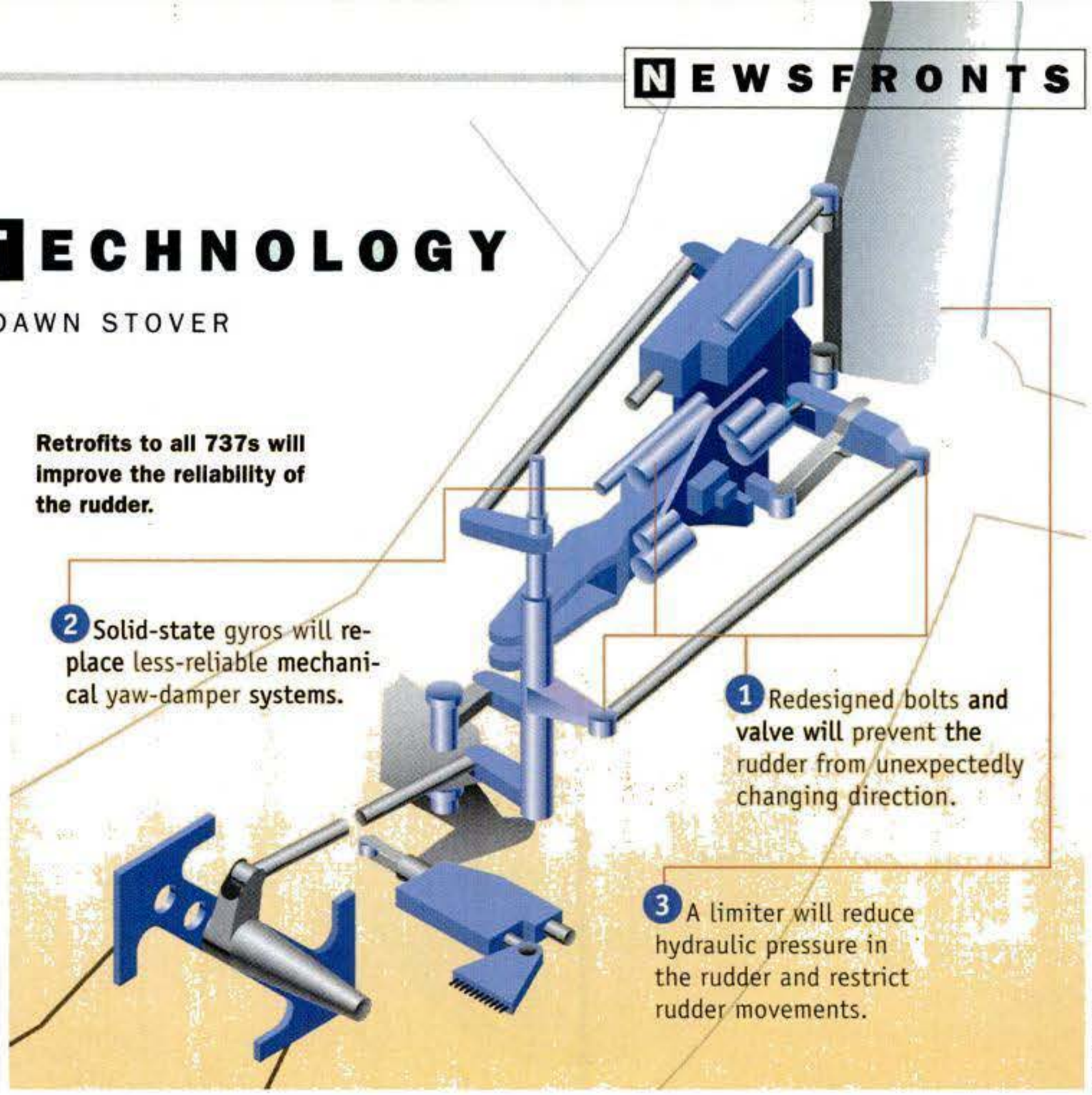
EDITED BY DAWN STOVER

AVIATION

Rudder Repair

WITH 2,800 PLANES plying the skies, the Boeing 737 is the most widely used commercial aircraft in the world. It carries 1.2 million passengers a day, so its mechanical safety is critical. After two unexplained accidents involving 737s in recent years, the U.S. government has ordered changes to the rudders of the nation's entire fleet.

Over the next two years, airlines will conduct a series of retrofits, predicted to cost a total of $150 million to $180 million. Boeing Co. has volunteered to supply the parts at no charge. The retrofits address the four possible ways that 737 rudders might have failed in two major crashes. In both cases, planes dove into the ground for no apparent reason. The 1991 crash near Colorado Springs claimed 25 lives; at Pittsburgh in 1994, 132 people died.



Retrofits to all 737s will improve the reliability of the rudder.

GREG MAXSON

Malfunctioning rudders are the suspected cause in both accidents, though that has not been proven.

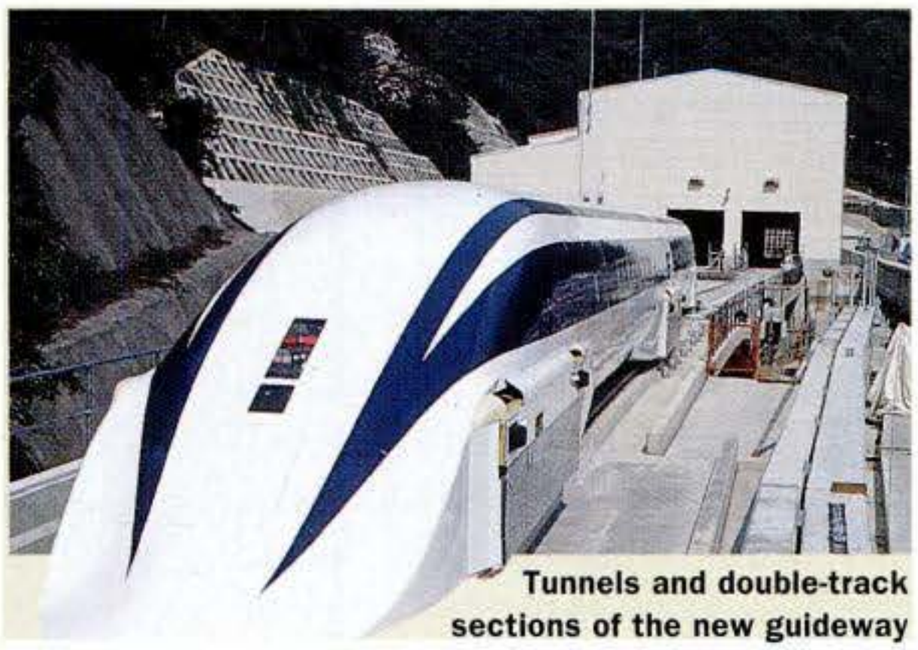
The retrofits include a redesigned valve that will prevent the aircraft's rudder from inadvertently changing direction, solid-state components that will replace existing mechanical systems, and a rudder limiter that will improve the crew's ability to control the aircraft. The redesigns are not expected to be completed until later this year. Afterward, the airlines will have two years to perform the retrofits. Meanwhile, airlines are instructing pilots in techniques to prevent potential rudder jams.—*Mariette DiChristina*

TRANSPORTATION

Maglev Floats Forward

THE WORLD'S MOST ambitious program to develop magnetically levitating trains took a step forward this spring when engineers in Japan started experimental runs on a new 11.5-mile-long test track just west of Tokyo. The goal is to develop trains that travel at more than 300 mph while magnetically suspended above a U-shaped guideway.

Previously, testing had been limited to half-scale train cars running along a short, straight guideway. The new test line, which will eventually be extended to 26 miles, has the grades, curves, switches, and stations needed to test full-size trains under actual operating conditions. If maglev proves technically and economically feasible, the test line will become part of a route linking Tokyo and Osaka. Maglev service would cut train travel time between the two cities from the current two-and-a-half hours to one hour.



Tunnels and double-track sections of the new guideway let trains pass in opposite directions.

Since maglev trains don't make physical contact with the guideway, track maintenance could be simplified. Currently, a crew of 3,000 keeps Japan's bullet-train tracks in shape.

Japan's test program will continue for two years. Meanwhile, researchers at the National Aviation and Transportation Center in Oakdale, New York, have unveiled the United States' first full-motion maglev simulator.—*Dennis Normile*

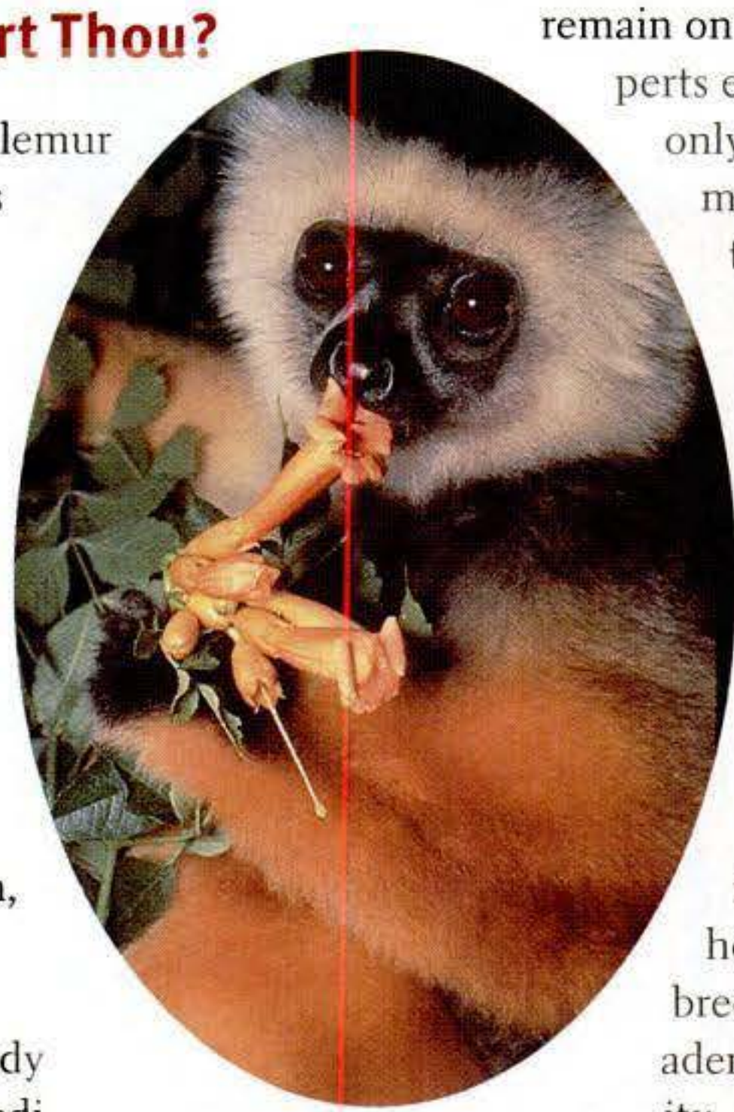
Copyrighted material

ANIMALS

Wherefore Art Thou?

THE four-year-old lemur named Romeo has been in captivity since the age of five months. In another year or two, he'll be mature enough for breeding. But alas, Romeo has no Juliet.

Researchers at the Duke Primate Center in Durham, North Carolina, where Romeo is housed, have already launched two expeditions to Madagascar in search of a female of Romeo's species—the diademed sifaka, the largest living lemur and a strikingly beautiful animal. Romeo is the only diademed sifaka in captivity.



Romeo the lemur awaits his mate.

In the wild, such lemurs are found only in Madagascar, where they have been decimated by poaching and habitat destruction. Nobody knows how many of the rare lemurs remain on the island, but experts estimate there are only a few thousand at most. During their two expeditions, researchers saw several diademed sifakas, but could not get close enough to shoot one with a tranquilizer dart.

A third expedition may return to Madagascar this fall. Researchers hope eventually to breed four pairs of diademed sifakas in captivity—two pairs at Duke, and two at a facility in Madagascar. Catching them won't be easy. "But they're clearly going to be eliminated in the wild if we don't do something," says Ken Glander, director of the Duke Primate Center. Until a Juliet can be found, Romeo is housed with lemurs of a closely related species.—*D.S.*

AVIATION

Baby BizJet

A TINY PRIVATE jet from Great Britain can take off from short 3,000-foot runways, and cruise for 1,500 miles at 500 mph. But the plane weighs only 4,000 pounds fully loaded—less than many cars.

The four-person CMC Leopard has an all-composite airframe and a slender, efficient wing with full-span, lift-boosting flaps. In place of conventional flight controls, the Leopard has three movable tail surfaces. There are no hydraulics: The flaps, landing gear, and canopy are electrically powered.

The first prototype has been flying since late 1988, but the program was stymied for a time by the lack of a small, efficient engine. Engine maker Williams International—whose jet engines power long-range cruise missiles—has remedied the problem by supplying the 700-pound-thrust FJX-1 for the second prototype, and is developing the 1,000-pound FJX-2 for the production version expected to debut this year. CMC is aiming the $1.25 million aircraft at private pilots and air taxi services.—*Bill Sweetman*

The sleek Leopard business jet has sports-car seats under an F-117-like clamshell canopy.

ROBOTICS

Crawling on Command

WHILE SOME researchers are building tiny robots that behave like mechanical insects, researchers at the University of Tokyo are taking an entirely different approach: adding electronic controls to live cockroaches. They may never be RoboCops fighting crime, but the "robo-roaches" may someday serve mankind in other ways.

To create the living robots, the researchers first remove the insects' wings, then fit them with a miniature backpack containing a remote control receiver, a battery, and electrical circuits. When the researchers send an electrical pulse through electrodes to an antenna mounted on the right side of the roach, the insect moves to the left, and vice versa. A jolt to pins stuck in the roach's rear moves it forward. Researchers are refining their control signals by steering the roaches through simple mazes. So far, the work has attracted little attention from animal-rights activists.

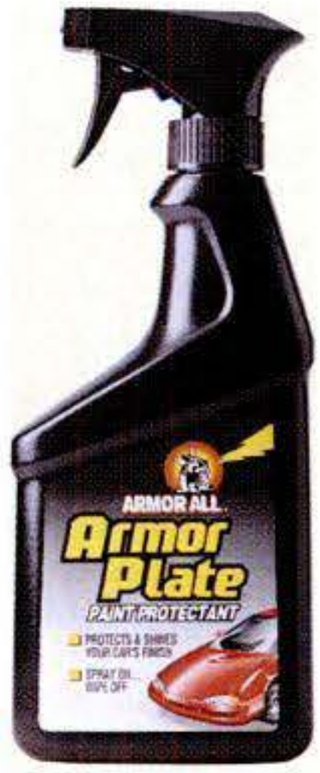
Isao Shimoyama, who leads the research, says that roaches can carry up to three times their own weight. So it might be possible to have roaches carry tiny cameras on inspection trips through broken gas pipes, for example. Purely mechanical devices developed for such tasks can't match the compact size, speed, and agility of the average roach.

Increased knowledge of how to control insect movements could also lead to new methods of pest control. But Shimoyama warns against expecting too much in this area. The main focus of the robo-roach research is not to build cyborg insects but simply to learn how insect neural systems function.—*D.N.*

Copyrighted material

Knight in shining armor.

Steve rescued this '64 T-bird from the scrap-yard and restored it by hand.
He loves to make it shine. That's why he uses Armor Plate Paint Protectant, from Armor All,
to shine and protect his paint after every wash.
It's as easy as spray and wipe and admire.



ARMOR ALL®

Armor Plate Paint Protectant
Shine and protection

www2.armorall.com/armorall/

©1997 THE CLOROX COMPANY

Copyrighted material

HEALTH

A Litmus Test for Tainted Food

BACTERIA KNOWN as *Escherichia coli* normally are harmless residents of the human intestinal tract. But one strain of *E. coli*, dubbed 0157:H7, is singularly nasty. It has caused serious illnesses and deaths in the United States and elsewhere. There were 10 deaths in Scotland alone last November, and 9,400 cases of food poisoning in Japan during the summer of 1995.

Most of the incidents have involved unpasteurized fruit juices and fast-food hamburgers that were not completely cooked. Children and the elderly are especially at risk. Outbreaks can cause diarrhea, internal bleeding, kidney damage, and in the most severe cases, death.

Until now, there has been no quick way for health inspectors or consumers to tell whether a particular food or drink is infected with this virulent strain of *E. coli*. The only way to detect it was after an outbreak, by culturing some of the suspect material for 24 hours and then using a variety of diagnostic techniques to identify the bacteria.

Now, however, chemists at the Lawrence Berkeley National Laboratory have developed a cheap, instantaneous litmus test for on-the-spot detection of food tainted with 0157:H7. Raymond Stevens, head of the Berkeley team, says that in the presence of the new sensor, this strain of *E. coli* causes a color change from blue to red. The greater the color change, the higher the concentration of the bacteria.

"We can make an inexpensive sensor that can be placed on a number of different materials, such as plastic, paper, or glass," Stevens says. "The cost of the sensor is so nominal that it could be part of a bottle cap or a container lid. If you open the product and the sensor has turned from blue to red, then you have a contaminated product."

Another new detection method, developed at Cornell University, uses a technique called fluorescent immunoassay to check for the bacteria. It is faster than the old methods, but still takes about seven hours.—*Arthur Fisher*

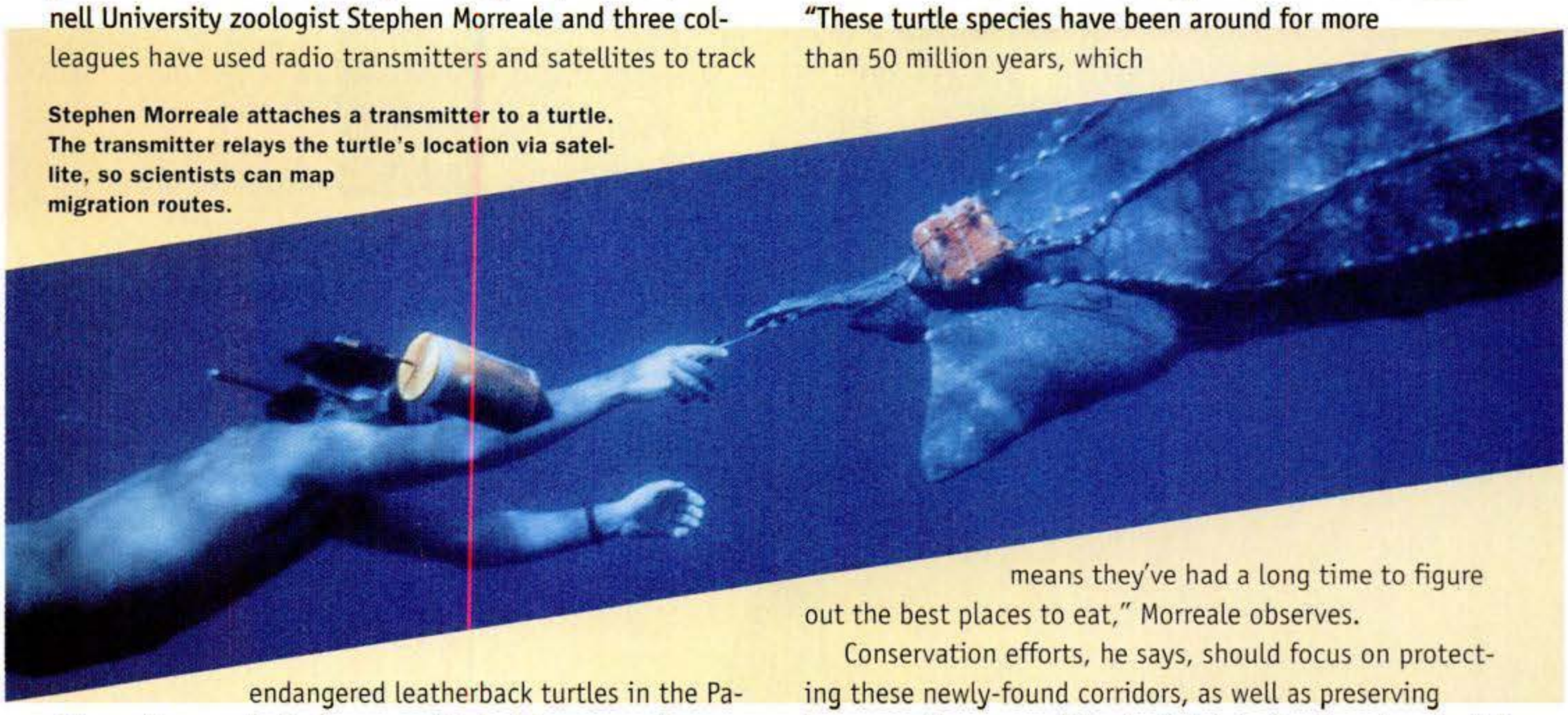
ENVIRONMENT

Turtle Highways

SEA TURTLES routinely make long journeys across the oceans, but until recently, little was known about their precise movements. For the past five years, however, Cornell University zoologist Stephen Morreale and three colleagues have used radio transmitters and satellites to track endangered leatherback turtles in the Pacific, as they made their way southward from a nesting beach in Costa Rica. To their surprise, the researchers found that, year after year, the turtles all followed similar paths on the open seas over distances often exceeding 1,000 miles.

The researchers have also discovered distinct turtle migration routes in the Caribbean Sea and the Atlantic Ocean. Nobody knows what guides leatherback turtles along these "corridors," although the scientists have ruled out surface currents, temperature, and ocean floor contours as likely explanations. The corridors may simply be narrow strips of ocean where food resources happen to be concentrated. "These turtle species have been around for more than 50 million years, which means they've had a long time to figure out the best places to eat," Morreale observes.

Conservation efforts, he says, should focus on protecting these newly-found corridors, as well as preserving known nesting areas. "The fact that turtles bunch up in this way makes them pretty vulnerable," he says. "On the other hand, since we can narrow down the area in which you have to be careful, and narrow down the time to certain months of the year, that might make it easier to protect these animals."—*Steve Nadis*



Stephen Morreale attaches a transmitter to a turtle. The transmitter relays the turtle's location via satellite, so scientists can map migration routes.

ED STANDORA/STATE UNIVERSITY COLLEGE AT BUFFALO

Copyrighted material

Knight in shining armor.

To Dan, this '95 VW Cabrio isn't just a car: it's his own private world, his personal space. He wants to keep it shined, protected and looking new. That's why he uses new Armor All Interior Protectant. Specially made to keep your interior looking new--without a greasy feel.

ARMOR ALL

New Interior Protectant
Non-greasy shine & protection

www2.armorall.com/armorall/

©1997 THE CLOROX COMPANY

Copyrighted material

EXPLORERS

Who Was First at the North Pole?

IN THE EARLY part of this century, two explorers laid claim to the discovery of the North Pole. Dr. Frederick A. Cook said he reached the top of the world in April 1908, a full year earlier than Robert E. Peary, but the social and scientific establishment of the time backed Peary. Now, an exhaustively researched book claims to finally settle the dispute: Neither Cook nor Peary made it to the Pole. That's the conclusion of *Cook & Peary: The Polar Controversy Resolved* (Stackpole Books), written by Robert M. Bryce, a research librarian at Montgomery College in Rockville, Maryland.

Although Peary's supporters have included heavyweights like the National Geographic Society, several major books have discredited his claims. Peary's tidy diary, for instance, should instead have been marked with walrus grease and the poor penmanship of a man writing in the dark and numbing cold. The diary pages for the days Peary claimed to be at the North Pole are blank. And his testimony before Congress in 1911 was marred by contradictions and inexplicable memory lapses.

Cook's claim, however, has not been so carefully investigated. Yet it too is fraudulent, says Bryce. Like Peary, Cook reported traveling at incredible speeds—averaging more than 15 miles a day over the rough ice pack of huge, drifting blocks. Cook's field notes show an ignorance of the mathematical concepts used to calculate latitude. Most damning of all, Bryce's research turned up a forgotten photocopy of a notebook containing evidence that Cook "cooked the books." Pages were erased and renumbered, dates were written over, and Cook's original observations did not match his published field notes. These discrepancies, writes Bryce, "suggest that Cook was improving his story as he went along."

Robert E. Peary laid claim to the Pole in 1909.

Dr. Frederick A. Cook said he was there a year earlier.

So who was first at the North Pole? Commander Richard E. Byrd and his pilot flew over it in May 1926. But not until 1995 did Richard Weber and Mikhail Malakhov become the first to make an unaided round trip to the Pole.—*D.S.*

MEDICINE

Breathing Easier

THERE ARE 150,000 Americans in acute respiratory distress. External respirators provide relief for some of these people, but in other cases they cannot deliver enough oxygen into the blood, and they can harm the lungs. Now, researchers at Northwestern University are developing a promising alternative to the respirator: an implantable artificial lung.

The researchers surgically attached the experimental device to five pigs for 24-hour intervals—a first, according to Lyle Mockros, professor of biomedical engineering, and graduate student Keith Cook. Previously, other scientists testing artificial lungs had only been able to keep animals alive for a few hours at most.

The ingenious plastic organ built by the Northwestern researchers has no energy supply. It is powered simply by blood flow from the heart. A muffler-like chamber the size of a pint of whiskey, the artificial lung contains 1.8 square meters of polypropylene fabric. The hollow fibers of the fabric serve as a medium in which pure oxygen (from an external tank) and oxygen-depleted blood can mix. Upon leaving the lung, the blood is infused with oxygen and freed of its toxic carbon dioxide—just as in a natural lung.

The researchers' next goal will be to make a soft, pliable lung that can be tested in sheep, which are docile enough to live with the device for more than 24 hours. Finally, in another five to 10 years, the researchers hope to implant artificial lungs in human patients who are awaiting transplants.
—*Mark D. Uehling*

Knight in shining armor.

Bob loves to work on his '94 Toyota 4x4,
but he cleans, shines and protects his tires without a lot of work.
When he uses Armor All Tire Foam, it's just spray and walk away.
For clean, shiny tires in one simple step.

ARMOR ALL®

Tire Foam
Cleans, shines and protects

www2.armorall.com/armorall/

©1997 THE CLOROX COMPANY

Copyrighted material

AUTOMOTIVE

EDITED BY DAN McCOSH

ENGINES

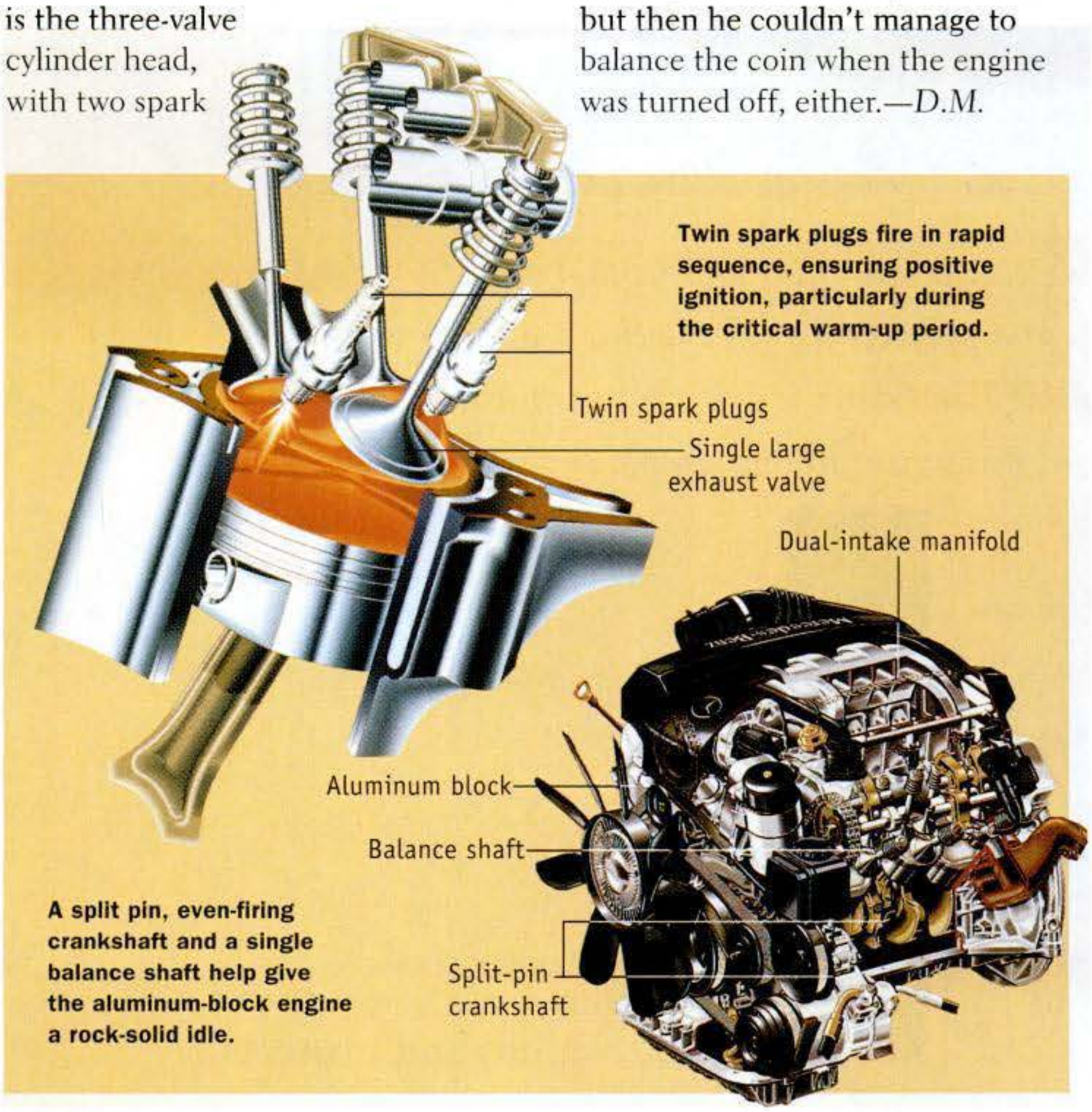
Mercedes Goes for V6

MOST MIDSIZE cars today offer a V6 option, which makes the introduction of a new V6 about on par with the debut of a new tire. One of the few holdouts has been Mercedes, which is replacing its inline six-cylinder engines with V6s in the E-class this fall. Late as it is, though, the design is a breakthrough.

The merits of Mercedes' old inline 3.2-liter six—mainly its inherent dynamic balance—are overwhelmed by the multiple advantages of the V6, including improved emissions, less weight, more compact design, and lower manufacturing costs. The latter is because some components are shared with Mercedes' V8.

The most noticeable innovation is the three-valve cylinder head, with two spark plugs per cylinder that fire in rapid sequence. The single exhaust valve reduces the cooling effect of the two exhaust valves in a four-valve engine and allows faster catalytic warm-up and light-off, as well as stable ignition of a lean mixture. That combination is crucial to meeting new emission standards that allow minimal unburned fuel during warm-up. The block is cast aluminum, with preformed silicon-aluminum cylinder liners. The engine produces 215 horsepower at 5,500 rpm, with 223 foot-pounds of torque at 3,000 rpm.

The even-firing, split-pin crankshaft and counter-rotating balance shaft help increase smoothness. The resulting rock-solid idle prompted a Mercedes engineer to try balancing a coin on the manifold while the engine was running. He failed, but then he couldn't manage to balance the coin when the engine was turned off, either.—*D.M.*



Twin spark plugs fire in rapid sequence, ensuring positive ignition, particularly during the critical warm-up period.

A split pin, even-firing crankshaft and a single balance shaft help give the aluminum-block engine a rock-solid idle.

PREVIEW DRIVE

Big Lives On

THERE IS A TOUCH of bravado in the launch of the redesigned 1998 Lincoln Town Car. Unabashedly big, the Town Car arrives as Cadillac retires the Brougham, leaving Lincoln alone with the kind of full-size, rear-drive sedan that once defined the luxury car.

The new 1998 Town Car has better aerodynamics and improved steering.

Designers gave the new Town Car some aerodynamic curves, and the new frame is slightly stiffer than before. Lincoln retains the body-on-frame design—a dwindling species these days.

Isolation from sound is usually cited as the main benefit of body-on-frame; the design also makes customizing the Town Car for duty as a limousine less of a chore. A significant percentage of Town Cars wind up as limos.

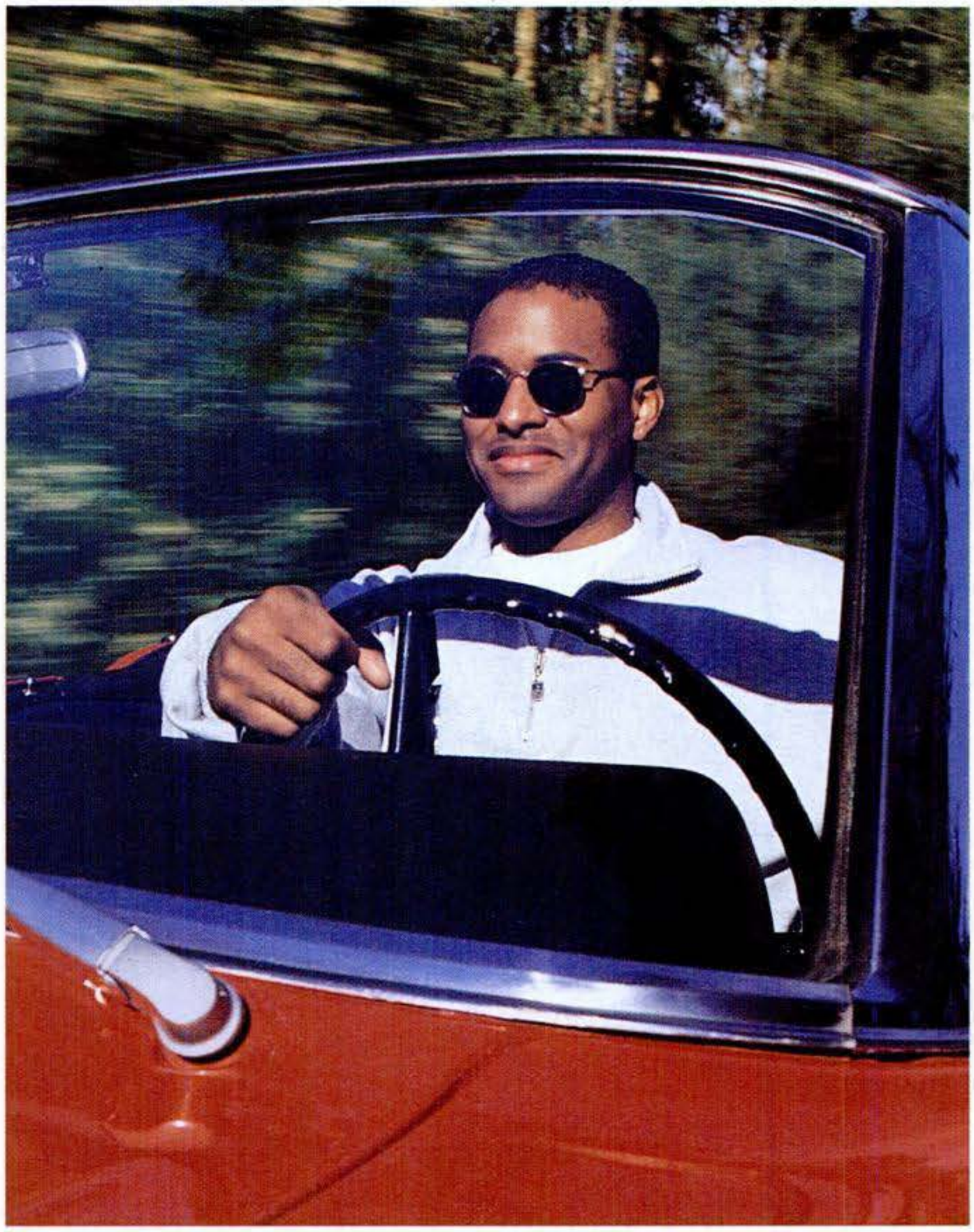
The suspension uses a new linkage system in the rear, where air springs provide the cushioning. The car's stiffer rear suspension, along with the application of anti-dive geometry, also means more precise steering.

An optional handling package includes suspension tuning and an additional 20 horsepower added to the base 4.6-liter 200-horsepower V8.

This Lincoln's pleasant combination of big-car characteristics is becoming increasingly rare these days.—*D.M.*

Copyrighted material

Knight in shining armor.



Derek's windows at home don't collect insects at 60 mph. And ordinary household glass cleaners aren't made for this kind of tough road grime. That's why he uses new Armor All Auto Glass Cleaner on his '66 Mustang. It's specially formulated to clean windshields to a streak-free, bug-free shine.

ARMOR ALL®

New Auto Glass Cleaner
Streak-free shine

www2.armorall.com/armorall/

©1997 THE CLOROX COMPANY

Copyrighted material

EVERYTHING WILL BE BETTER IN THIS CENTURY.

(Camry drivers take special note.)

Seating for Six

3100 V6 with Automatic Transmission

Dual Zone Climate Control

Battery Rundown Protection

Air Filtration Syster

GM ®©1997 GM Corp. All rights reserved. Century is a registered trademark of GM Corp. Always wear safety belts, even with air bags.
*Maintenance needs vary with different uses and driving conditions. See Owner's Manual for details. **Mid-size car class as defined by U.S. EPA Interior Volume Index.
†MSRP including dealer prep and destination charge. Tax, license and optional equipment additional. MSRP slightly higher in CA, WA, OR and ID. Competitive MSRPs as reported Feb. 1997.

Introducing The All-New Century By Buick.

Taurus and Accord drivers, you might want to take note too. Because this Century is vastly different from the last — redesigned from top to bottom, bumper to bumper and every place in between. Its 3100 V6 can go 100,000 miles* without a tune-up. And it's filled with so many luxurious touches like remote keyless entry, dual zone climate control and an air filtration system that removes most allergy-causing pollens. Hey, the new Century is so bright, it even turns its own lights on and off.

	Buick Century Custom	Camry LE V6	Taurus GL V6	Accord LX V6
EPA Interior Room (cu ft)	118.5	111.0	116.8	107.7
Dual Zone Climate Control	Incl.	N/A	N/A	N/A
Remote Keyless Entry	Std.	Opt.	Opt.	Opt.
Air Filtration	Std.	N/A	Incl.	N/A
Price	$19,368	$22,588	$19,825	$22,895

Everything Will Be More Comfortable In This Century.

More spacious too.** Century has more room than Camry, Accord, Taurus and just about every other mid-size car you can think of (we're told there's a Rolls-Royce that's roomier). It genuinely seats six people comfortably.

Everything Will Be Quieter In This Century.

An advanced system of sound barriers makes the new Century remarkably quiet. A trait which has been winning it accolades from the press and passengers alike. And one last point, because we're serious about changing what you park in your garage, we gave this Century something else you'll like: a surprisingly down-to-earth price — very well equipped for under $19,400.† To find out more, visit our Web site at www.century.buick.com or call 1-800-4A-BUICK.

Century®

Discover a little luxury in this Century.

Dual Air Bags

Four-Wheel Anti-Lock Brakes

Remote Keyless Entry

Very Well Equipped For Under $19,400.

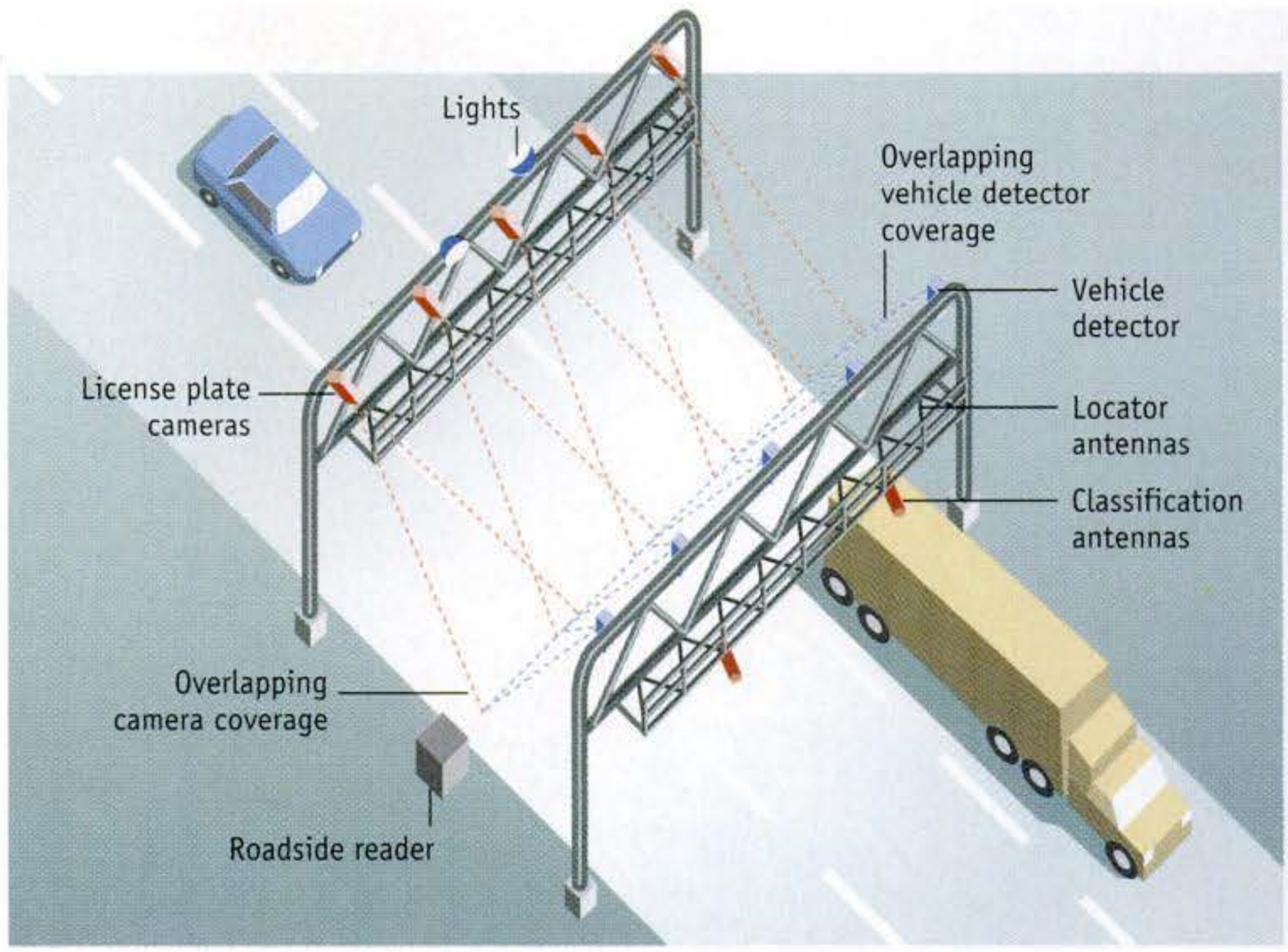
By Buick

Copyrighted material

SMART ROADS

Laser Tollbooths

THE TECHNOLOGY that guides a Cruise missile is now playing a different role on Ontario's new Highway 407, across the top of metropolitan Toronto. There, laser beam "curtains" are recording digital video images of license plates on vehicles passing below. It's part of the world's most advanced electronic toll collection system, according to Martin Gray, program manager for the consortium of companies that built the system. The technology was originally developed by Hughes Aircraft Corp. in the United States for military airborne and land communications applications.



ALEX REARDON

Commuters entering the high-tech tollbooth are scrutinized by overhead cameras and lasers that classify vehicle type and calculate the toll. The information ends up as a bill in the mail.

Frequent commuters lease a transponder that attaches behind the rearview mirror and signals mileages to roadside readers connected by fiber-optic cable. Drivers later get a bill based on the mileage they have traveled. A digital video-image system captures images of rear license plates from the vehicles of occasional drivers as the vehicles enter and leave on the highway's ramps under laser beam devices mounted on overhead gantries. These laser detectors triangulate the position of each vehicle as it approaches the ramps. The system also establishes—even at speeds as high as 200 kilometers per hour—whether the vehicle is in a light classification (car, van, motorcycle, pickup, and so on) or is a larger truck, which requires a different toll rate. By spotting transponders and vehicles that don't match lease records, it can also prevent cheating.

A proprietary pattern-matching technology allows cameras to zoom in on the rear license plates of vehicles that don't have transponders. An automated optical-reading capability can sort out license plates for Ontario, other provinces, and adjacent U.S. states.—*Albert Warson*

PREVIEW DRIVE

Regal's Renaissance

BUICK IS AIMING ITS sights high with a new 1997 midyear Regal, targeting Accord and Camry buyers who are looking to step up in performance.

The new Regal is a platform-mate to the Pontiac Grand Prix and Oldsmobile Intrigue. Conceived as a hybrid sporty/family sedan, the Buick is the best example yet of the effectiveness of GM's flexible "vehicle architecture." This approach allows cars sharing similar chassis and drivetrains to have as much as a three-inch variation in wheelbase for both styling and functional distinctions. The Regal rides on a 109-inch wheelbase, while its Pontiac "twin" is stretched to 110.5. Accordingly, Regal has an upright, family-car roofline, while the sportier Grand Prix has faster windshield and backlight angles.

To further differentiate the Regal, Buick uses an exclusive rubber-isolated rear cross member as an attachment point for the suspension. This design retains crisp handling but provides the road-noise isolation Buick customers have come to expect. Front suspension on all three cars is tuned to each car's "personality" through bushing rates and shock valving. Regal is offered in two models; a surprisingly quick, 195-horsepower V6-powered LS ($20,545) and a tire-smoking 240-hp, supercharged GS ($22,945). —*Gerry Kobe*

The new Buick Regal challenges the imports with a softer ride, luxury features.

© 1997 Pennzoil Products Company.

1962 **For Carbureted Engines.**

1997 **Cleans Your Fuel-Injected Engines.**

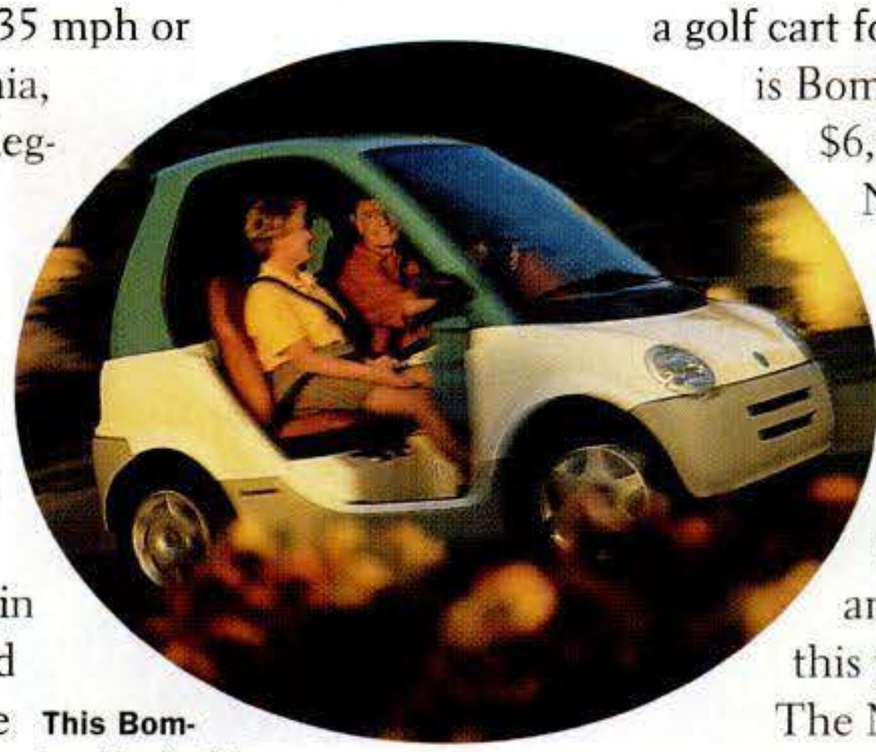
2032 **We're Working On It.**

We've Been Helping Cars Breathe Easier Since 1962. Gumout.® Better Cleaning For Better Performance.™

ELECTRIC CARS

Green Streets

GOLF CARTS ON city streets? It may be an increasingly common sight. Arizona has passed legislation allowing "neighborhood electric vehicles" to be driven on streets with speed zones of 35 mph or less. In California, newly enacted legislation authorizes cities to allow NEVs and golf carts to be street-driven on roads with 25-mph speed limits, or in specially marked lanes. The same is true for cities in Florida.



This Bombardier "golf cart" is among the first developed for highways.

Why zip around in a golf cart? The obvious advantages are low cost and friendliness to the environment. During short trips, a car's catalytic converter barely reaches operating temperature before the engine is shut down again—with significant emissions. Golf carts cause no such emissions.

Street-driven golf carts fall into a gray area with the National Highway Traffic Safety Administration (NHTSA), however. Currently, specialty vehicles produced in numbers under 10,000 can receive exemptions from specific NHTSA standards if the specifications are deemed too costly or impractical to meet.

One of the first companies to sell a golf cart for street driving is Bombardier, whose $6,699 Bombardier NEV recently went on sale in Arizona. Bombardier says it may introduce the tiny vehicle in California and Florida later this year.

The NEV is a two-seater that runs on seven GNB Champion lead-acid batteries powering a 4-kilowatt traction motor, humming along at a sedate 25 mph. The range is about 30 miles on a single charge. Bombardier's version of the NEV comes with an array of car-like features, including turn signals, four-wheel independent suspension, hydraulic brakes, rack-and-pinion steering, and three-point seat belts.—*Ron Cogan*

DESIGN

Squirm You Must

CAN'T GET comfortable in your car? Your discomfort is the subject of a lengthy study by researchers at Michigan State University. Their solution to the problem: a seat design that conforms to the articulation of the human body.

Studies indicate that such a seat is preferable to today's rigid seats—even those that have adjustable lumbar supports. Conventional seating tends to press against the natural curvature of the spine, causing discomfort, particularly over long drives. The research led to the design of a seating concept called the Biomechanically Articulated Chair, which uses two separate pivoting sections —one to support the pelvis and the other to support the rib cage. An adjustable shock cord connects the pivoting sections to control the support for the lower back.

This chair allows considerable adjustment, while maintaining support in critical areas, according to its developers. The design also can be used in other types of furniture and seating where posture and long-haul comfort is important, including office, aircraft, and medical seats (a dental chair, for example).—*D.M.*

SUVs

No-Slip 4WD

MERCEDES' 4 MATIC four-wheel-drive system, to be available on its E-class sedans this fall, provides a preview of the all-wheel-drive system planned for upcoming Mercedes sport utilities and rumored to be in the works on Jeeps as well.

The system effectively incorporates the four-wheel disc brakes into the traction system. Rather than distributing torque fore and aft and side to side with a variation of a friction clutch—the method favored by most current all-wheel-drive systems—Mercedes uses a simple open differential for both front and rear axles, plus the transfer case. The main advantage is light weight, since neither viscous nor magnetic clutches are necessary.

A slipping wheel at any of the four corners is detected via a traction-control system and then gripped, effectively transferring the torque to the wheels with traction. The system also produces a decidedly different sensation for the driver when it begins to engage. On the highway, the light weight and torque split (65 percent to the rear wheels) render the system nearly unnoticeable. Encountering sloppy and slippery snow, it starts to plod through in a sure-footed manner. But when wheels begin to spin in choppy going, the traction system takes over. Power seems to disappear underfoot, as the engine bogs and each wheel seeks its own way. It's disconcerting, but progress continues until dry pavement emerges, and the operations revert to normal.

A yaw-sensitive spin-control system is optional, adding single-wheel braking to prevent spinouts. The combination of the two may be the ultimate for slippery-weather driving.—*D.M.*

Copyrighted material

© 1997 MNA, Inc.

Some People Follow The Stocks. Others Make Sure They Don't Get Away.

UNIROYAL®

LAREDO®

Tried. And True.™

There's a good reason Laredo® Light Truck Tires are made tough with DuraShield® construction. They're put to the test every day to be as reliable, as dependable and as true as the folks who choose them.

Copyrighted material

Since 1822,
Copenhagen has satisfied
the toughest customers.
That tradition continues.

Introducing

Copenhagen® Long Cut.

New Copenhagen® Long Cut.
The same premium tobacco.
Same original flavor.
In a whole new cut.

Born & Bred From The Original.

U.S. TOBACCO REMINDS YOU
NOT FOR SALE TO MINORS
SMOKELESS TOBACCO

WARNING:
THIS PRODUCT MAY CAUSE GUM DISEASE AND TOOTH LOSS

® Copenhagen is a trademark of U.S. Tobacco Co. or its affiliates for its smokeless tobacco.
© 1997 U.S. Tobacco Co.

HOME TECHNOLOGY

EDITED BY JUDITH ANNE GUNTHER

MATERIALS

Wheat Concrete

WHAT'S GOOD for you may soon be good for your home, too. The U.S. Department of Agriculture in Albany, California, has developed lightweight concrete that uses wheat starch.

Riddled with thousands of air pockets, lightweight concrete is now being used for everything from floors to roofing tiles.

One way to make lightweight concrete is to add perlite or hollow beads made of recycled plastic. But when the cement is poured, these can float to the surface, making the concrete vary in density. Another method is to mix in a foam. The foam, however, can compress under the weight of wet concrete.

USDA researcher Gregory Glenn says the wheat starch method overcomes these drawbacks. The starch is mixed with water, then dried and milled into little particles. When soaked in water, these particles form aquagels—rubbery, translucent granules. Added to wet cement, the tough little aquagels don't compress, nor do they float. As the cement cures, the aquagels dry up, leaving a small air pocket and a tiny kernel of starch that weighs about one-quarter of the original aquagel.

The concrete is now being evaluated by an independent lab.—*J.A.G.*

CONSTRUCTION

Arch Deluxe

IN A GEOMETRICAL twist on an old construction standby, a small company in Alfred, New York, has developed unusual new shapes for concrete blocks. The shapes would enable a builder to construct arches, vaults, and geodesic domes—designs ordinarily beyond the abilities of the classic rectangular block.

An early block prototype.

PolyCeramic's blocks are triangular, roughly 16 inches long per side, with zigzag-like edges. These facets enable the blocks to interlock as they're stacked. All together, there are four shapes, with slightly different dimensions and facets. Builders could combine two of them to make domes, for example, and another two to make cylinders. One block, oriented first with the point up, then point down, makes a straight, flat wall.

A big advantage of this system, says inventor Peter Roberts, is that the interlocking design makes the walls of these blocks very strong. That could make PolyCeramic blocks an excellent housing alternative for regions threatened by hurricanes, tornadoes, or earthquakes. The blocks might also find their way into landscaping applications, unusually shaped swimming pools, highway department salt-storage domes—even mausoleums.

PolyCeramics is now negotiating with an equipment manufacturer to mass-produce its concrete blocks. If produced in quantity, the blocks could be priced competitively with standard masonry.—*J.A.G.*

STATISTICS

ALEX REARDON

Recipe for a House

EVER WONDER JUST HOW much stuff it takes to build a typical single-family house? Here's the answer, based on information collected by the National Association of Home Builders in Washington, D.C.

- 3,100 sq. ft. of roofing material
- 2,325 sq. ft. of exterior siding material
- 120 linear feet of ducting
- 6,212 sq. ft. of sheathing
- 3,061 sq. ft. of insulation
- 2,085 sq. ft. of flooring material
- 2,100 sq. ft. of interior ceiling material
- 13.97 tons of concrete
- 13,127 board-feet of framing lumber

Copyrighted material

HOME REPAIR

Web Fixes

TODAY'S household handyman needs a good set of tools—and maybe the right Internet connections. That's because a growing number of sites on the Internet's World Wide Web are doing more than advertising their wares: They're showing you how to tackle all kinds of home improvement projects.

Much of the how-to advice is coming from companies that manufacture the tools or raw materials for such jobs. Bosch Power Tools (*www.boschtools.com*), for example, recently featured on its Web site illustrated articles showing how to build a fan trellis or a set of stairs. (You need to download Adobe's free Acrobat document reader to view these articles, however.) Wallboard maker USG (*www.usgcorp.com*) has DYI WorkShop on its site, detailing, among other things, how to hang, finish, and repair drywall. Owens Corning (*www.owenscorning.com*) hosts an online give-and-take about home improvements called The Front Porch, as well as more than you'll likely ever want to know about insulation and roofing. Marvin Windows (*www.marvin.com*) adds a clever interactive touch with its Build Your Own window maker, which requires the popular Shockwave "plug-in" software for your Web browser.

Some independent sites offer home counsel, too. One of the best is HouseNet (*www.housenet.com*), which provides samples of quick, easy woodworking projects like book racks, a foot stool, and a kitchen trivet. In addition, the site offers a nice variety of advice, projects, how-to articles, and "neighbor-to-neighbor" tips. And when your neighborhood is in cyberspace, there's almost always someone on the other side of the fence willing to help.—*Chris O'Malley*

Not sure how to get started with a project? Web sites like HouseNet offer "how-to" help, advice, and project plans.

HOME & HEALTH

Aqua Lung

SO YOU THINK THAT the biggest threat to your health when taking a shower comes from slipping on a bar of soap? Well, guess again.

Preliminary studies by engineers at the University of Cincinnati and the Oak Ridge Institute for Science and Education, also in Cincinnati, indicate that some water-saving shower nozzles produce water droplets so small they can be inhaled, exposing anyone using the shower to several different health hazards.

Using a device called an optical particle counter, the researchers tested a number of shower nozzles, both adjustable and fixed-spray styles. They found that some products create droplets less than 10 microns in diameter—small enough to be inhaled. That's a problem, the researchers theorize, because the water may contain traces of chemicals used by treatment facilities to disinfect the water. These volatile organic compounds are relatively safe to ingest by drinking, but may not be safe to inhale.

Another threat may be possible as well. Previous research has shown that the droplets can contain microbes that live inside the warm, wet interior of shower nozzles. When the faucet is turned on, these microbes are swept out through the nozzles. If these droplets are inhaled, the microbes could pose a threat to people with asthma and other respiratory problems.

All of this doesn't mean you should skip your morning shower just yet. More research is needed, cautions Oak Ridge Institute scientist Virendra Sethi, before anyone can determine just how serious—or insignificant—these health risks may be. Moreover, not all water-conserving nozzles produce inhalable droplets. "It all depends on the design of the nozzle," says Sethi. Right now, there is no way for consumers to know which nozzles produce these tiny drops. "We are working to develop specifications for shower head designs that would not generate droplets in the inhalable size range," he adds.—*J.A.G.*

ELECTRONICS

EDITED BY FRANK VIZARD

HANDS ON

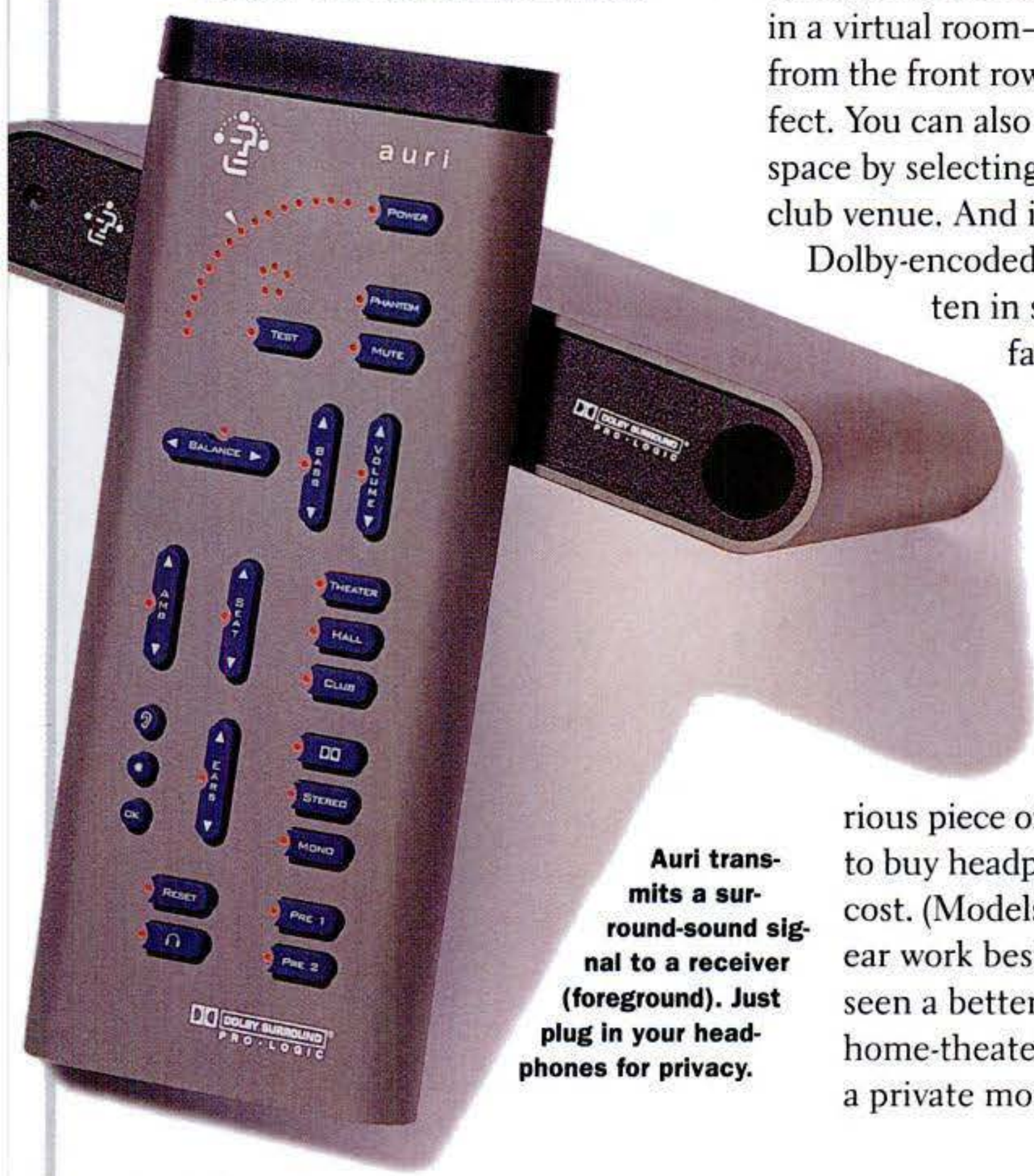
Home Theater Becomes a Private Moment

MAYBE YOU'VE seen the TV commercial where a SWAT team comes to investigate the sound produced by a home-theater system. If you're concerned that realistic surround-sound may attract the attention of local authorities or neighbors, you may be interested in an accessory that reproduces surround-sound effects through headphones.

Unlike other systems available, Auri, made by Virtual Listening Systems of Gainesville, Florida, doesn't require special dual-speaker headphones and doesn't need to be hard-wired directly to individual speakers. You simply connect a transmitter to the audio-out jacks on the back of the TV, VCR, or receiver. The transmitter sends the Dolby Pro Logic surround-sound data via a radio signal to a handheld receiver, to which you can connect any pair of headphones.

This alone won't recreate an effective surround-sound experience, however. Auri uses what the company calls Toltec processing, a mix of acoustic engineering that combines the principles of binaural listening, studies on how the outer ear directs different sounds, and a healthy dose of digital sound processing provided by a Motorola Symphony 56000 chip. The effect is like listening to five speakers strategically placed all around you in a room.

Controls on the Auri receiver enable you to manipulate your position in a virtual room—letting you move from the front row to the back, in effect. You can also alter the perceived space by selecting a theater, hall, or club venue. And if the movie isn't Dolby-encoded, you can still listen in standard stereo. In fact, the amount of custom tailoring you can do—even down to controlling the bass—is very impressive. With a list price of $499, the Auri is a serious piece of gear, and the need to buy headphones is a hidden cost. (Models that enclose your ear work best.) But we haven't seen a better way to turn the home-theater experience into a private moment.—*F.V.*



Auri transmits a surround-sound signal to a receiver (foreground). Just plug in your headphones for privacy.

HANDS ON

E-mail Pager

MUCH OF LIFE'S daily communication comes in short bursts—rescheduled meetings, location changes, fact verification, affirmatives, and negatives. So a small device that can handle most of these communiqués while keeping you mobile is a handy tool. That's why a new pager from SkyTel is so useful. The SkyWriter, as it is called, is alphanumeric, so messages are in plain English (and by necessity short, since you spell out the message letter by letter). But what makes the pager especially useful is that it sends messages through the Internet. This means you can send e-mail to anyone, even while you're on the move. The SkyTel Web site can also be used to send e-mail messages to you.

The SkyWriter pager lets you send messages via the internet.

Another clever feature is pager-to-pager communication. Recently, a colleague and I used our SkyWriter pagers to continuously coordinate our movements during an outdoor photo shoot even though we were 20 city blocks apart—it was like using a radio without the static.

The lack of a backlit screen can make reading messages in dim light tough. But the price is right. The monthly fee is $25 for nationwide service (though rural coverage is spotty). Tack on another $15 per month if you lease the pager; it costs $399 to buy it. Compared with the cost of cell phones and other alphanumeric paging services, these prices are very competitive—and you even get news updates.—*F.V.*

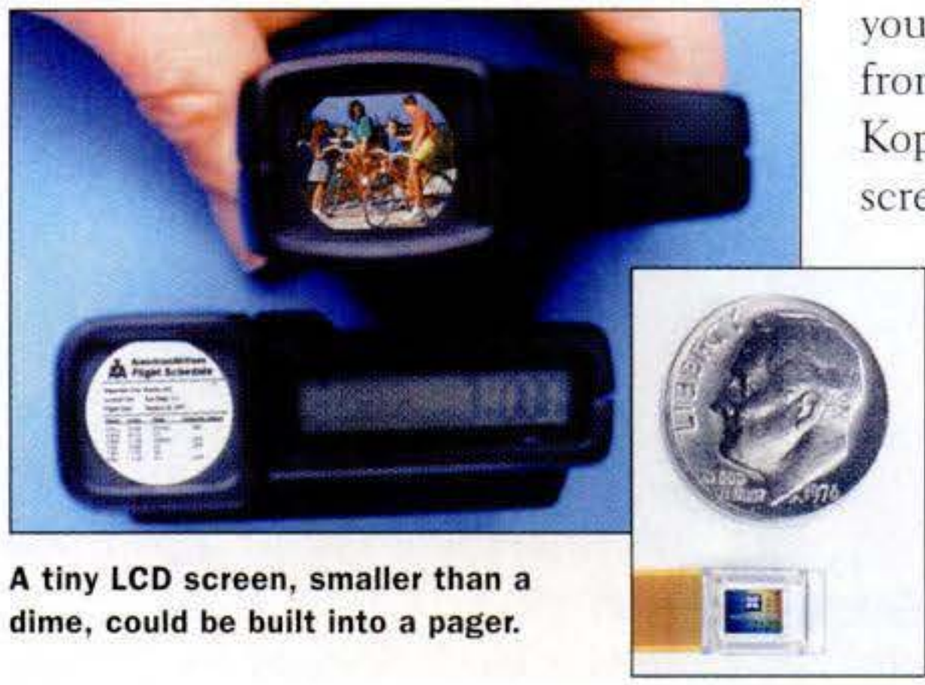
Copyrighted material

DISPLAYS

Small-time Viewer

IMAGINE READING a fax or gazing at a Web page from the Internet on the pager or cellular phone you're using. That's what Kopin Corp. of Taunton, Massachusetts, hopes you'll be doing in about two years with its new Cyber Display, a 1/4-inch, active-matrix LCD screen.

The tiny screen, coupled with a magnifier, can be added to mobile communications devices for the viewing of words, pictures, and even video. When you look through the viewer, it seems as if you're watching a 20-inch display from about five feet away. The Kopin screen is similar to LCD screens used in laptop computers, but is many times smaller. Kopin expects to sell product developers a 320- by 240-pixel monochrome display first, and later a color display. Given product development cycles, Kopin expects devices using its display to be available in 18 months to two years. Other products that could use this display include watches and cameras.—*F.V.*



A tiny LCD screen, smaller than a dime, could be built into a pager.

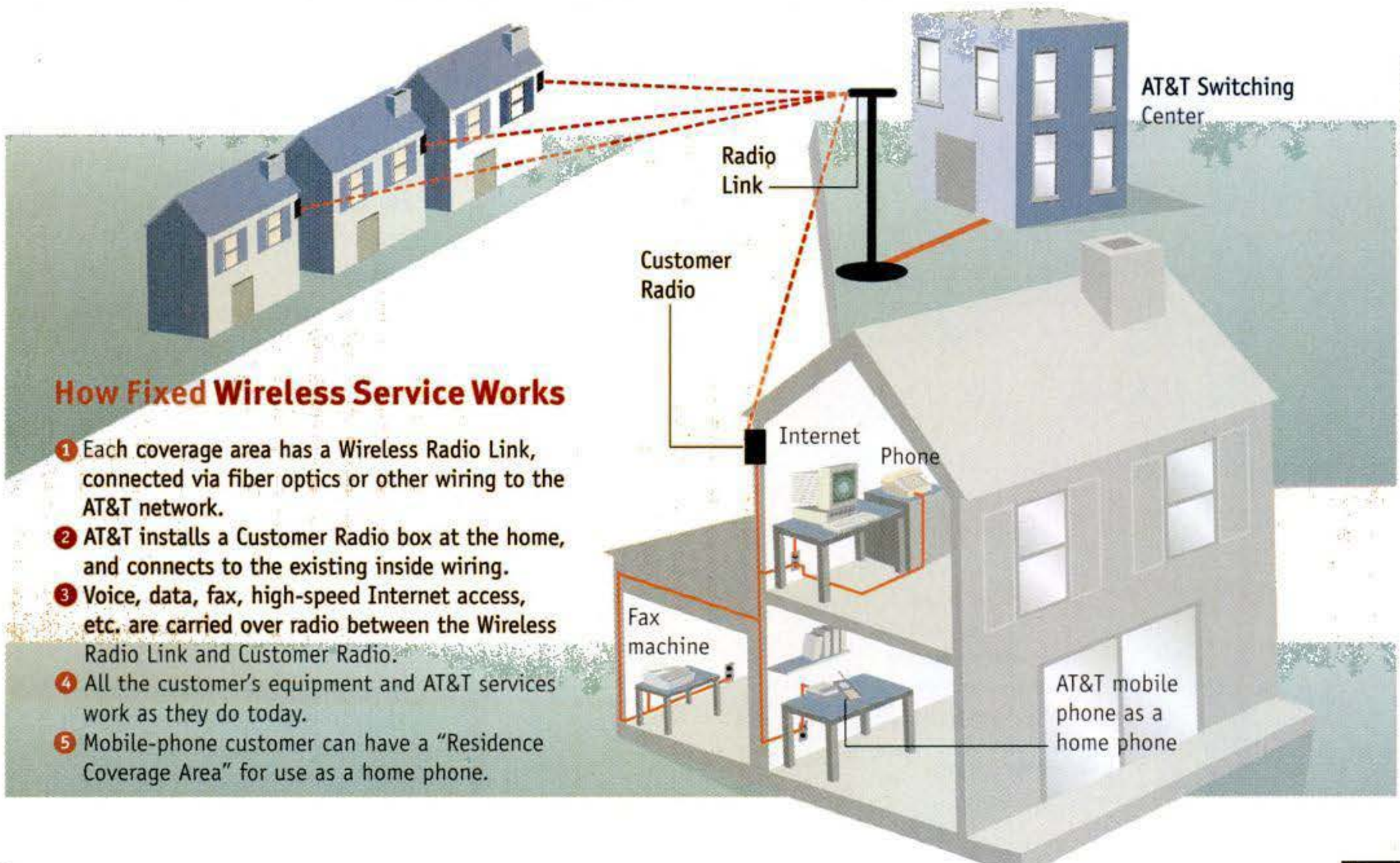
TELEPHONES

Wireless at Home

AT&T IS DEVELOPING a technology that may allow you to use the same phone at home and on the road. At the core of Project Angel is a transceiver, about the size of a pizza box, that is attached to the side of your house. The transceiver is linked wirelessly (using the 10MHz band) to larger neighborhood antennas that can service as many as 2,000 customers each. This antenna is connected to a digital switching center that routes your call.

The technology is expected to be available in two years; each customer will initially have two phones lines and the capability for Internet access at a very fast 128,000 bits per second. Existing touch-tone phones can still be used with this service. Mobile phones can be used as in-house extensions, giving them extra versatility. Or you can dispense with the wired phone and simply use wireless for both home and travel.

This "fixed wireless" system was actually being developed by McCaw Cellular Communications prior to AT&T's takeover. It wasn't until after the acquisition that AT&T knew of its existence. This technology is expected to give AT&T a competitive edge in the battle for providing local service. AT&T says it is now working on techniques that will greatly increase the capacity of the 10MHz spectrum and make it as fast as fiber-optic delivery. During the past two years, AT&T has quietly acquired through FCC auctions the licenses in the 10MHz spectrum it needs to provide service to 93 percent of the country.—*F.V.*

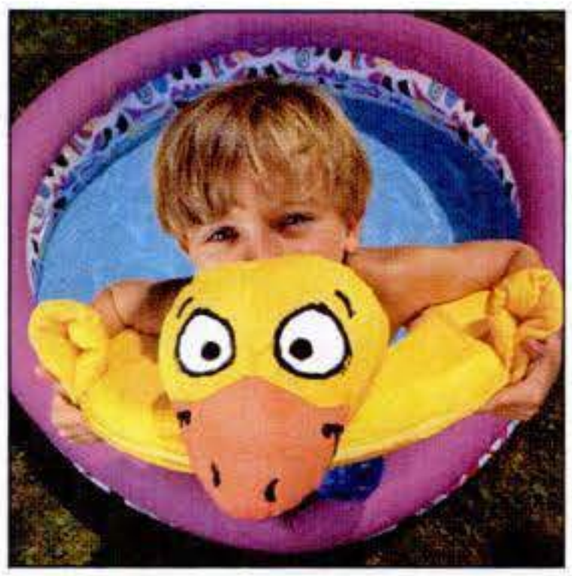


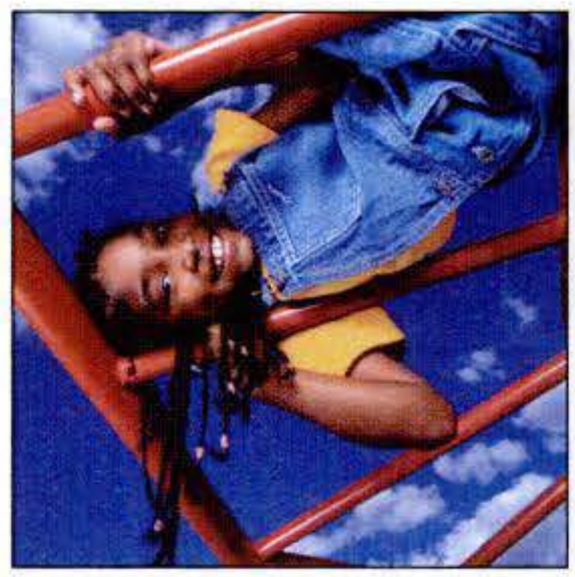
REBECCA PERRY

How Fixed Wireless Service Works

1. Each coverage area has a Wireless Radio Link, connected via fiber optics or other wiring to the AT&T network.
2. AT&T installs a Customer Radio box at the home, and connects to the existing inside wiring.
3. Voice, data, fax, high-speed Internet access, etc. are carried over radio between the Wireless Radio Link and Customer Radio.
4. All the customer's equipment and AT&T services work as they do today.
5. Mobile-phone customer can have a "Residence Coverage Area" for use as a home phone.

Copyrighted material





Lumina owners have at least one reason to drive a car this safe.

Lumina LS Here are some more: standard dual air bags, ABS, Daytime Running Lamps, child security rear door locks and power window lockout. There's even an integrated child safety seat option. Fact is, no six-passenger car in its class can offer as many standard safety features for the money as a Chevy™ Lumina® LS.* A small price to pay for a lot less to worry about. That's something that any parent can appreciate.

Genuine Chevrolet®
The Cars More Americans Trust.

Call **1-800-950-2438** or visit **www.chevrolet.com** *Excludes other GM products. ©1996 GM Corp. Buckle up, America!

Copyrighted material

VIDEO GAMES

An Eye for Action

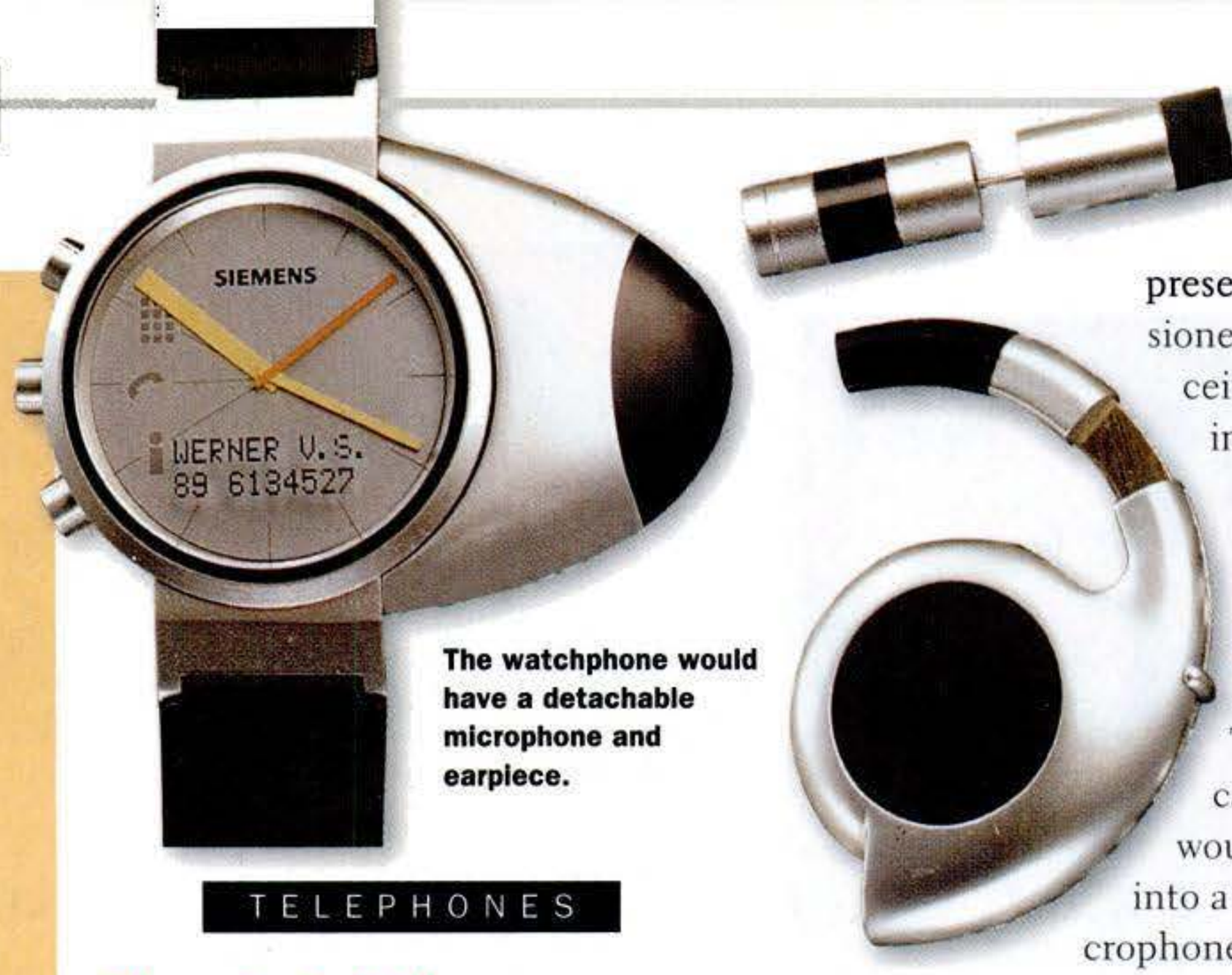
A COMPUTERIZED camera that translates the movements of human players into the actions of onscreen characters is being developed by Sega and Mitsubishi. The heart of the camera, called an artificial retina chip, is built around a square array of photoelectric cells.

"The artificial retina chip gives the photoelectric cells the ability to detect an image and process that image similarly to how rods and cones detect and process images in a human retina," says Bill Freeman, principal researcher for the U.S. arm of Mitsubishi Electric Research Laboratories.

The research prototype already built by Freeman and his colleagues is a small box with a camera that sits on top of a TV. The prototype has a square array of 32 photoelectric cells, but an array of as many as 256 cells, for a wider area of coverage, is feasible, says Freeman. As the camera looks out at a player, a microprocessor takes a reading from the camera every 10 milliseconds. This prevents a noticeable time lag and allows for real-time game play.

As a test, the artificial retina chip was used in a video game called Decathlete. Former couch potatoes were left exhausted after running, jumping, and throwing their way through 10 virtual events.—*Joseph Baneth Allen*

Physical movements are mirrored onscreen.



The watchphone would have a detachable microphone and earpiece.

TELEPHONES

Time to Call Home

WHEN NEW YEAR'S Day for the next millennium rushes in, you may be able to call friends and family using a phone wrapped around your wrist. Swatch and Siemens are jointly working toward the development of a watch telephone to be introduced around the year 2000. As presently envisioned, a receiver stored in a slot behind the watch would clip to your ear. To make calls, you would speak into a small microphone that clips to your shirt. You'd dial numbers using voice-recognition software. This software would most likely be embedded in the telephone network, rather than in the watch itself, to save space. One stumbling block to development: stretching the life of the tiny batteries that would be needed to power the wristwatch phone.—*Marcus Gibson*

VIDEO GAMES

Faster IR Links

COMPUTER AND electronics manufacturers are developing universal infrared codes that would enable all infrared control devices to communicate compatibly—and at high speeds. That would mean you could carry your joystick to play on a different video game console at a friend's house, for example, or have your TV beam data to any printer.

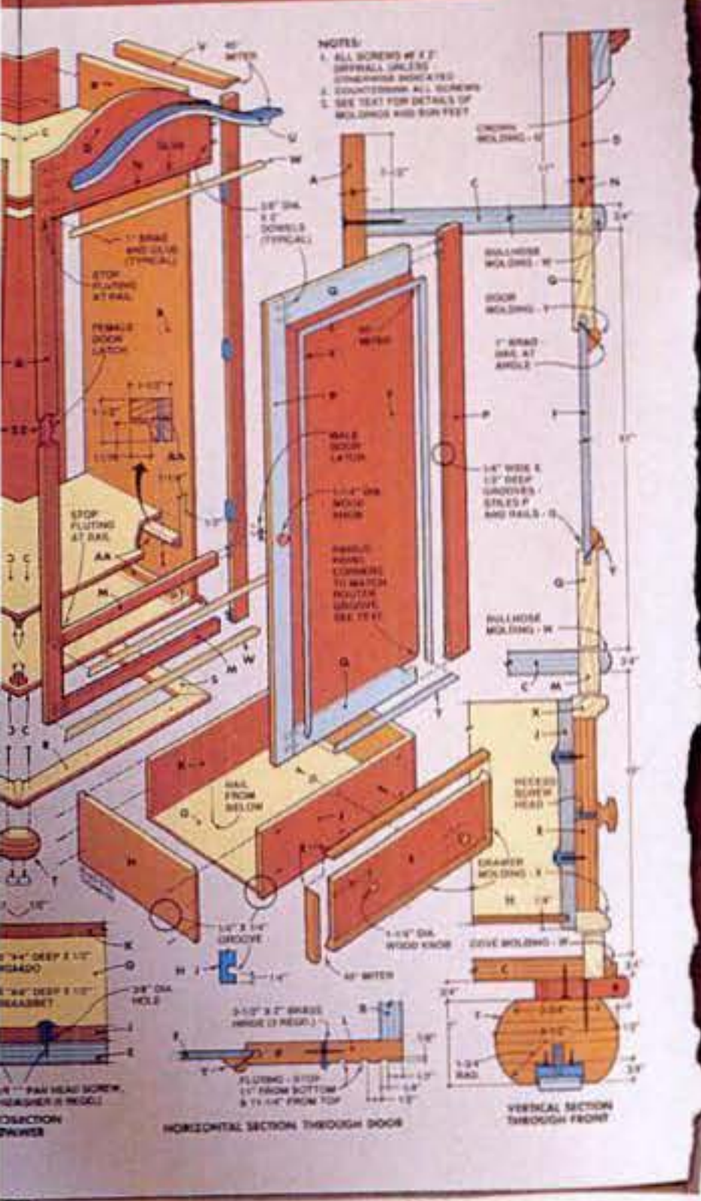
This lingua franca for infrared is called Control IR, and if the standard is adopted, products could be on the market later this year. According to John La Roche, executive director of the Infrared Data Association (IrDA), major companies working on the project include Hewlett-Packard, Intel, Logitech, Microsoft, Philips, and Sharp.

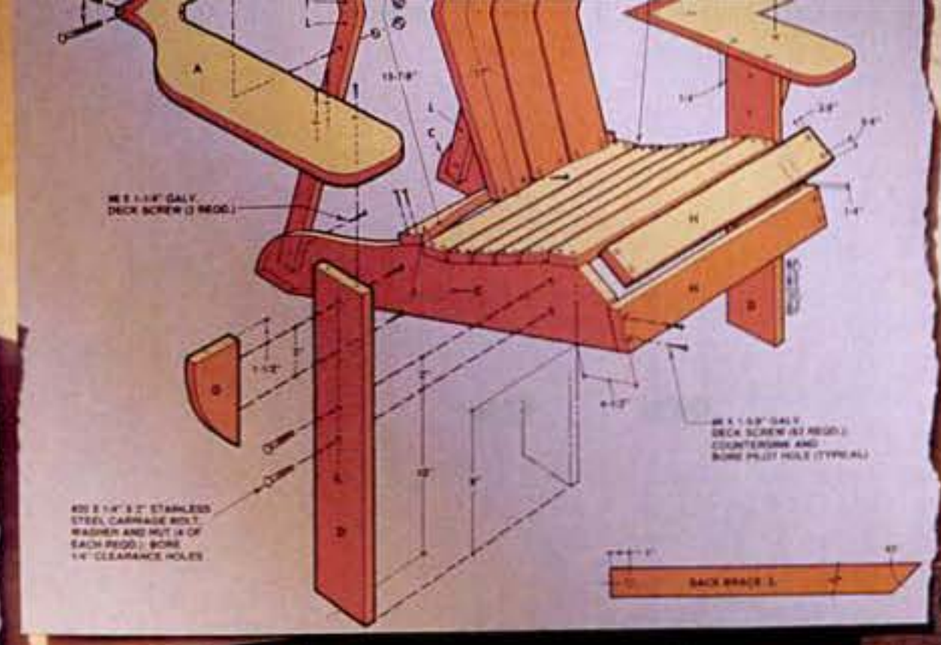
La Roche explains that, besides a shared language of codes and the capacity to learn new ones, Control IR devices will differ from today's infrared transceivers primarily in their communication speed, and in their ability to support multiple connections simultaneously. For example, Control IR devices would transmit data at 50 to 60 kilobits per second, compared with the 1.2-kilobit rate used by current TV zappers and wireless keyboards. At this speed, La Roche notes, devices such as video games could juggle commands from as many as four remote controllers simultaneously, and without time delay.

The code would also permit cross-platform functionality, creating a virtual pipeline connecting different services and environments. For example, a wireless keyboard or zapper could instruct a Web-browsing TV to send pages to an IR printer within its 30-foot range. Because Control IR is envisioned as a two-way link, the printer could beam its identifying information to the set-top box—or to any portable or desktop PC from which you might want to print.—*Stephen A. Booth*

LOOK A LITTLE SCARY?

FIG. A CHERRY WARDROBE





Deck Construction

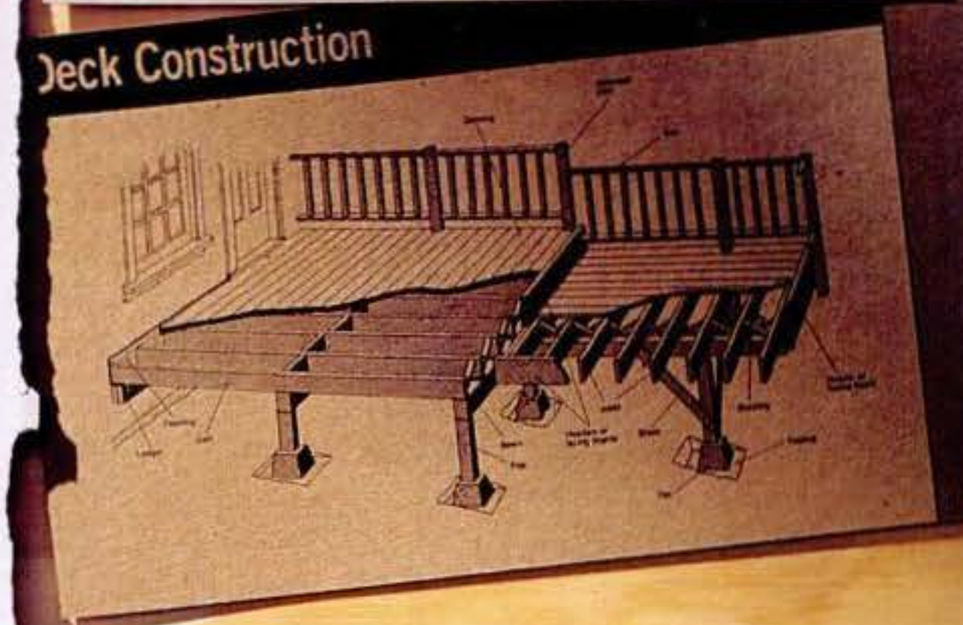
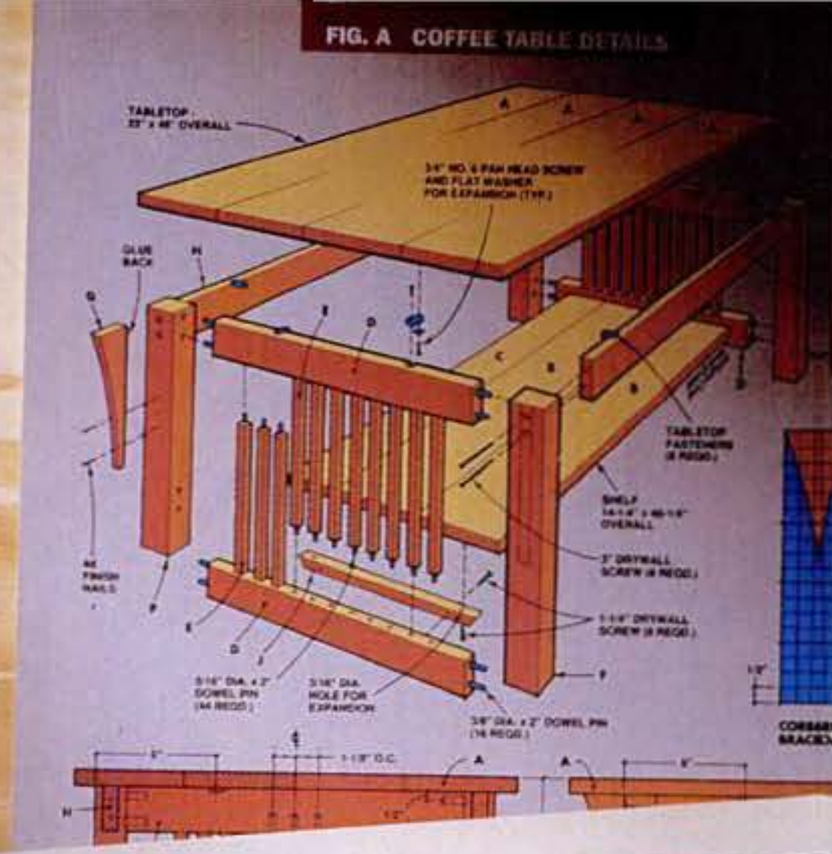
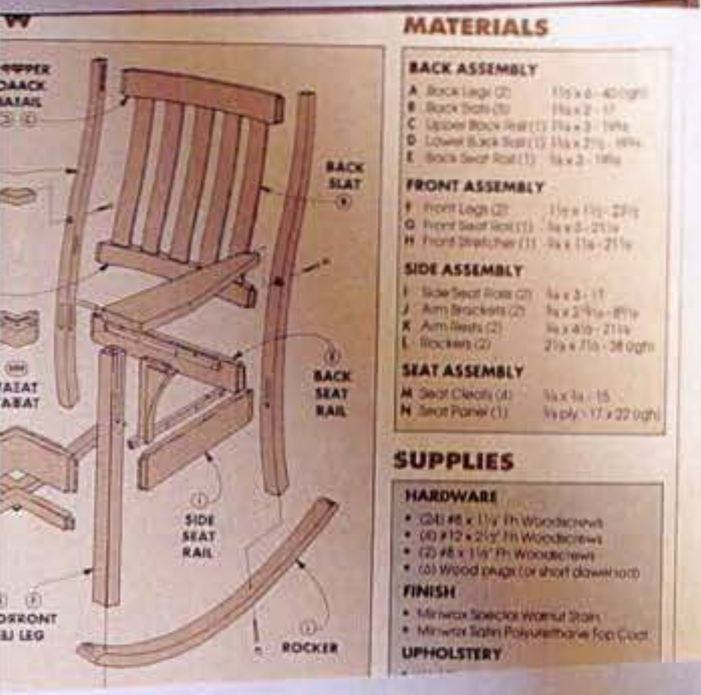


FIG. A COFFEE TABLE DETAILS





MATERIALS

BACK ASSEMBLY

FRONT ASSEMBLY

SIDE ASSEMBLY

SEAT ASSEMBLY

SUPPLIES

HARDWARE

FINISH

UPHOLSTERY

EXPLODED VIEW

MATERIALS

CASE

DRAWERS

OVERALL DIMENSIONS: 40"W x 21"D x 42"H

CUTTING DIAGRAM

SUPPLIES

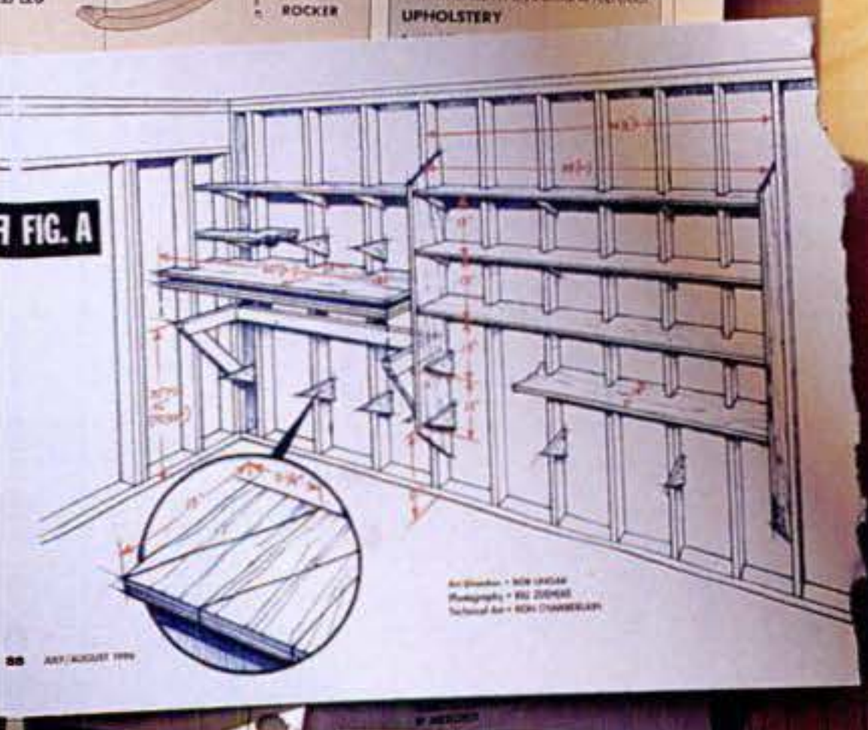


FIG. A

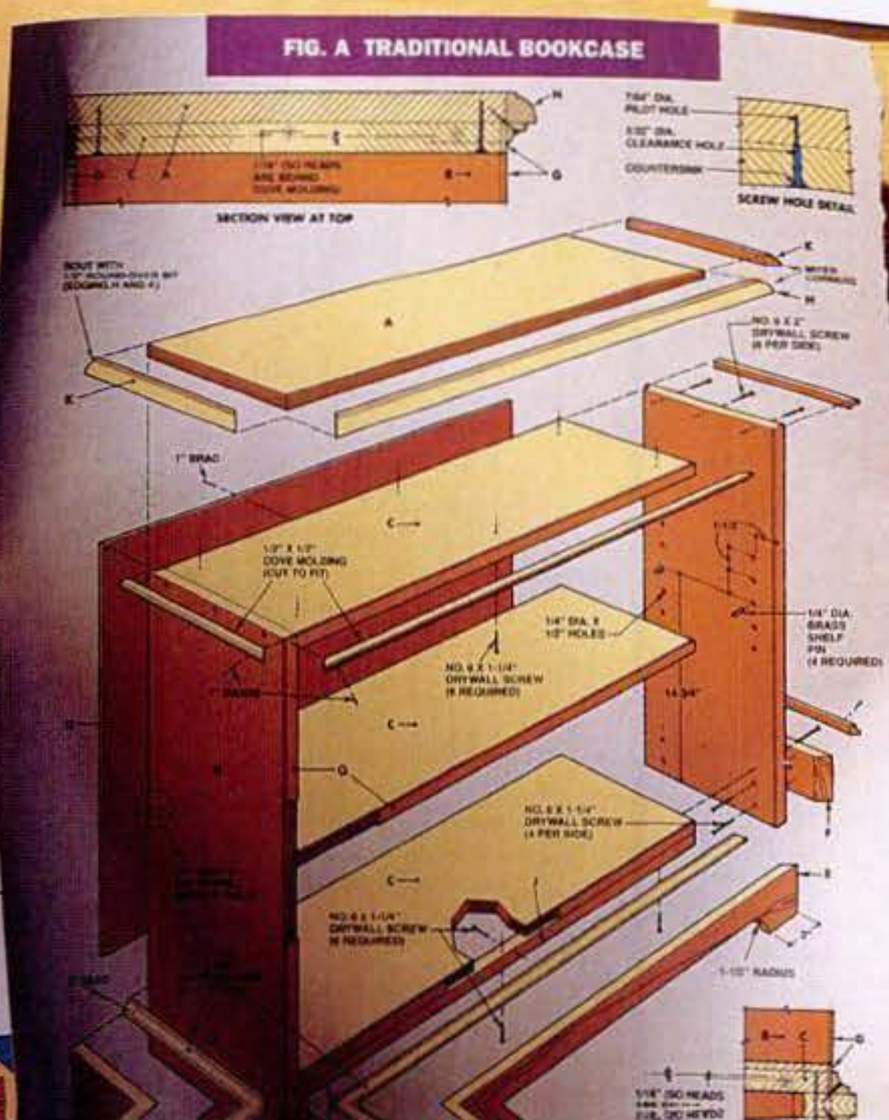


FIG. A TRADITIONAL BOOKCASE

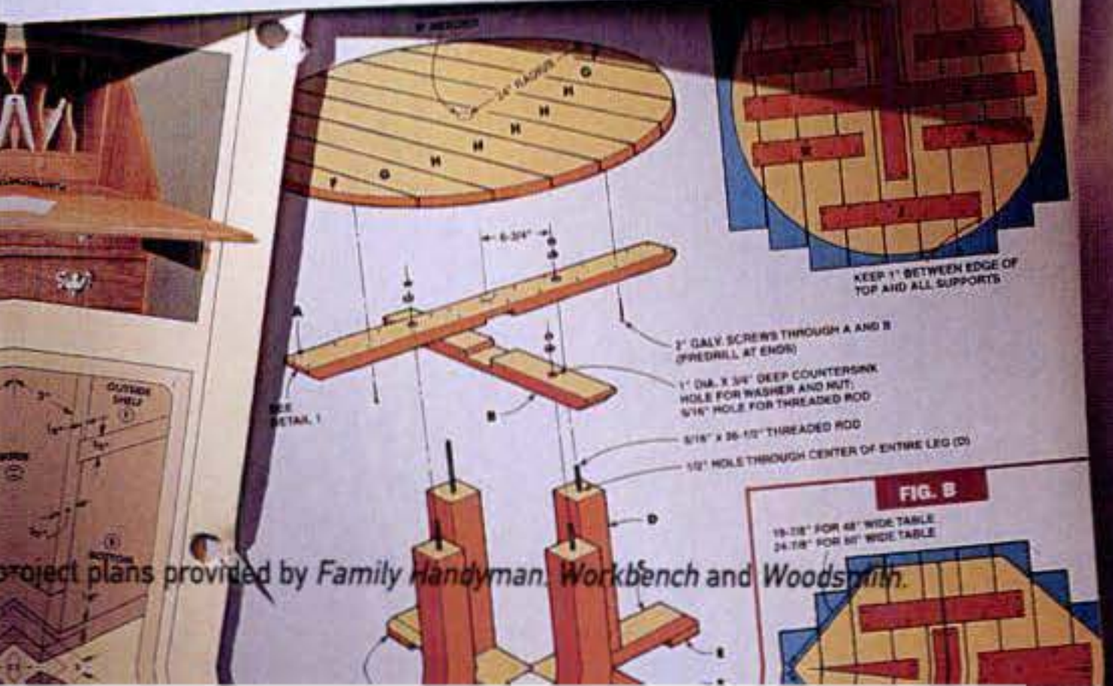
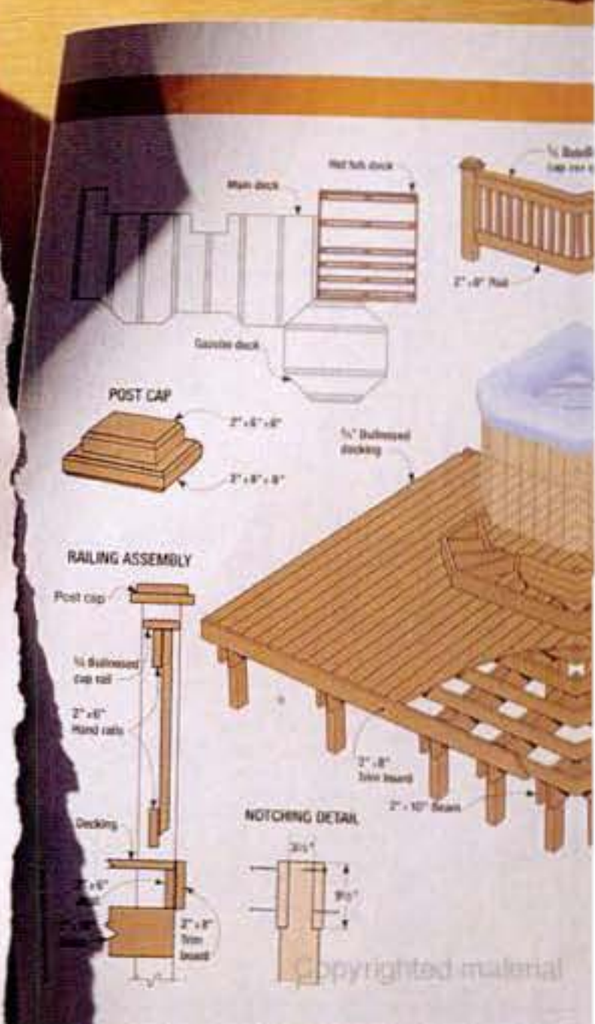


FIG. B



POST CAP

RAILING ASSEMBLY

NOTCHING DETAIL

Window Sill Repair

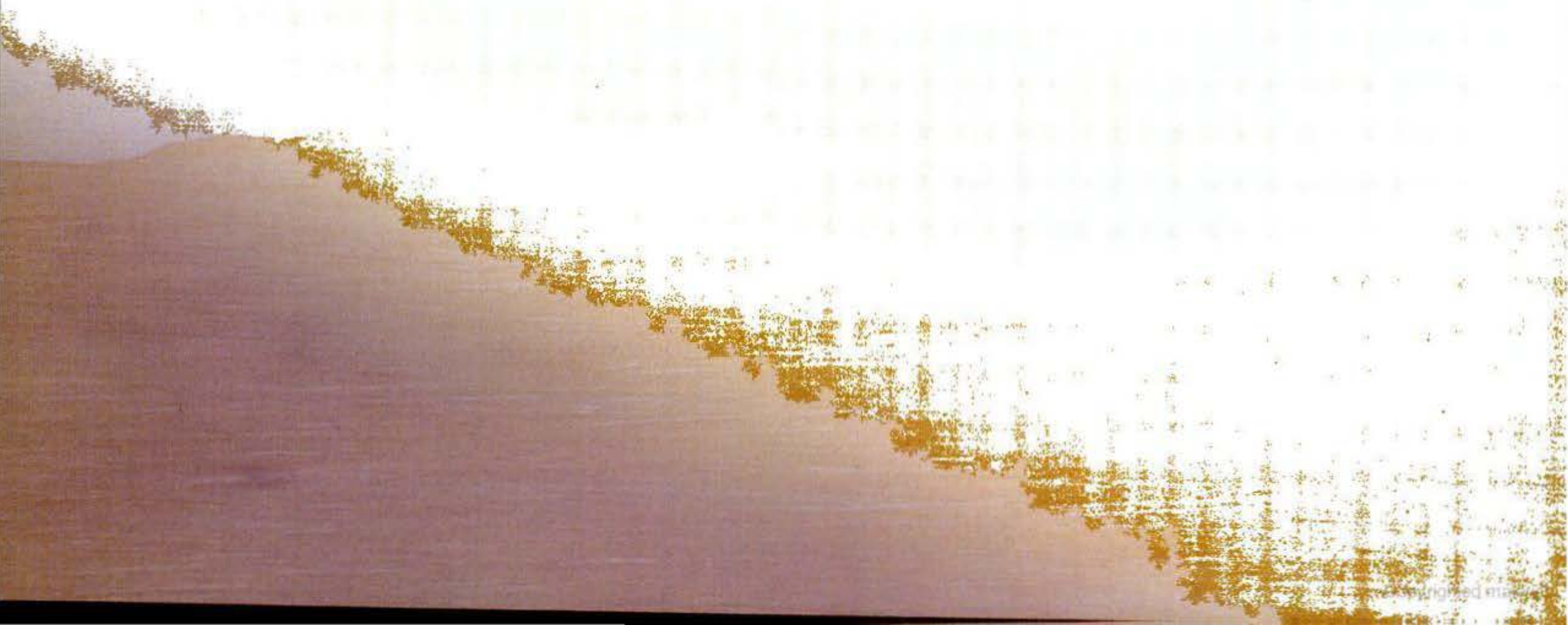
Instead of buying new frames, some problems can be fixed yourself.

It's a big project, but you're just the person to do it, with a little help from us. Read over all the plans carefully before you begin, also make sure you have the proper tools and safety equipment.

Project plans provided by *Family Handyman*, *Workbench* and *Woodsmith*.

Copyrighted material

OBVIOUSLY YOU NEED MORE GUTS.



Established 1924

THE NEW STUFF FROM SKIL®

4300 W. Peterson, Chicago, IL 60646

SKIL INTRODUCES a completely new line of power tools with tons of innovative features and power. So now you can tackle tough jobs without a second thought.

The Skil Jigsaws | *The new jigsaws have more power and features to make quick work of the most demanding cuts.*

- # Up To 4.0 Amp Motor for heavier jobs
- # Vacuum Hose Port for cleaner work area
- # Dynamic Vibration Reduction for smoother operation

The Skilsaw® | *The standard of circular saws has a tool box of new features making it easier than ever to use.*

- # Rear Depth Adjustment for easier setting
- # Lower Guard Lift Lever for pocket cuts
- # Front Foot Scale for quicker measurement

The Skil Drills | *The new drills, with up to 4.5 amps, have the power to blast through just about anything.*

- # Level Guide for accurate drilling
- # Variable Speed Dial adjusts to each task
- # Improved Ergonomics to reduce fatigue

IF YOU'VE EVER looked a project straight in the eyes and blinked, it's time to get yourself the power tools with the stuff to face anything.

© 1997 S-B Power Tool Company.

SKIL POWER TOOLS®

THE LEGEND KEEPS BUILDING!

Circular Saws

Belt Sanders

Corded Drills

Jigsaws

Random Orbit Sanders

Cordless Drills

Table Saws

Detail Sanders

Power Screwdrivers

Routers

Palm Grip Sanders

Miter Saws

Power Scrapers

Plate Joiners

Grinders

WHATEVER JOB YOU'VE GOT TO DO, SKIL MAKES THE TOOL TO GET IT DONE.

There are hundreds of Skil Power Tools and accessories made to do practically any job you can think of. So whatever plans you're looking at, now you can see them all the way through.

SKIL POWER TOOLS®

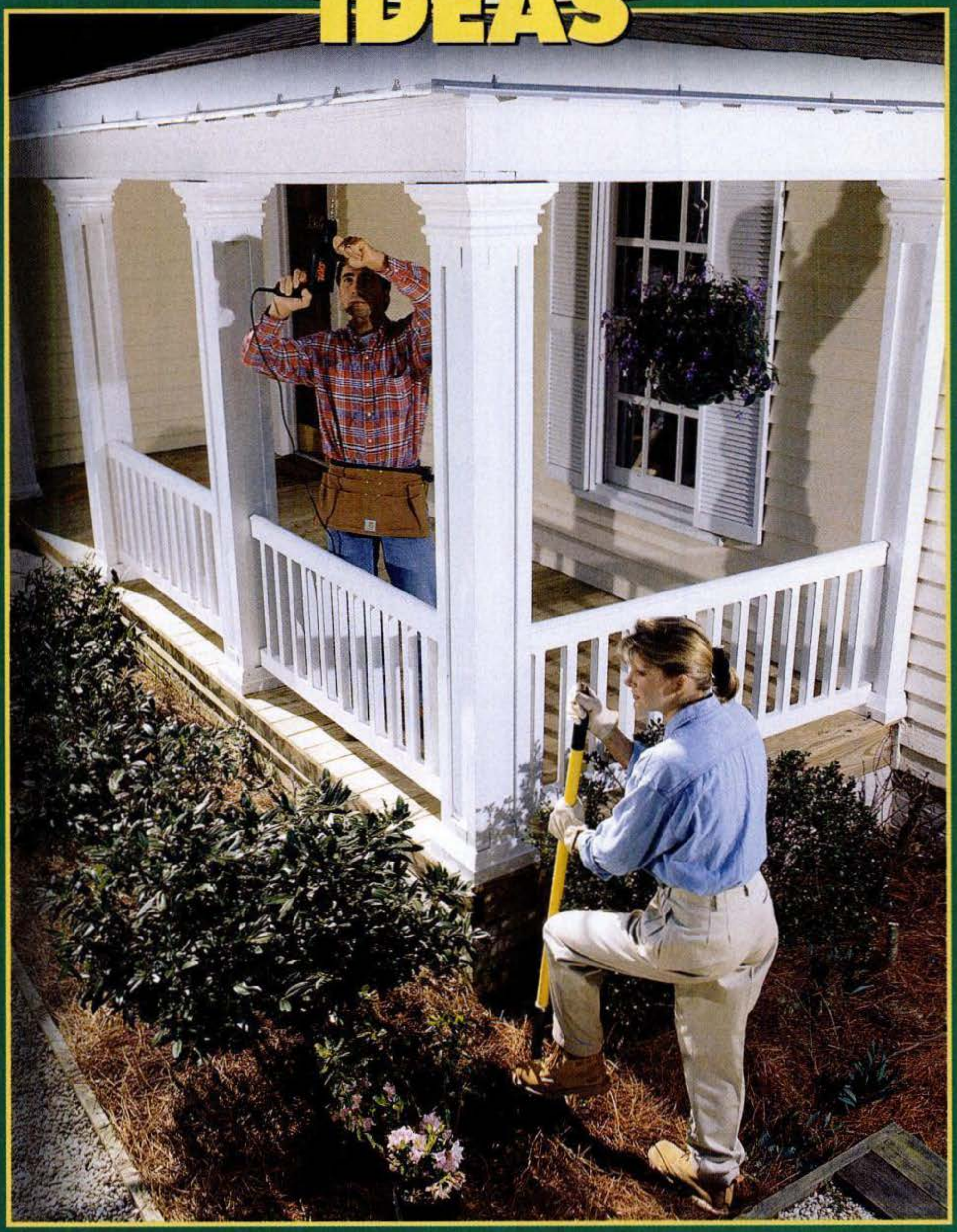
THE LEGEND KEEPS BUILDING.

www.skiltools.com

Copyrighted material

SPECIAL ADVERTISING SECTION

HOME Remodeling IDEAS



Projects, products and tools for indoor and

Copyrighted material

HOME *Remodeling* IDEAS

There are times when having the right tools can

After a long winter season, few home owners can resist the urge to get back out into the yard and garden—even though there's usually plenty of work that needs to be done there. Cold weather, snow, rain, and freeze/thaw cycles can be tough on a house and its surroundings. So despite its charms, spring is not so much a time for basking in the warm sunshine as it is for getting out the tools for weekends filled with maintenance, repair and renovation.

Often, having the right tools can mean the difference between rewarding work and work that's harder than it has to be, and sometimes it is critical to the successful completion of a project. When you buy tools for your home, you want them to perform, and you want them to last. Most home owners build their workshop collections gradually, adding tools as they need them. A well-made tool may last as long as your home, if maintained in good condition, and may prove useful many times over the years. But if you buy something thinking you'll need it "just once" for a specific job, there is always a temptation to spend less and opt for lower quality. Name-brand, professional-grade tools can be

Gardening isn't a chore when you've got dependable equipment. Our Ace lawn and garden tools, like all Ace Brand hand tools, offer a lifetime guarantee and are tested to ensure that their quality is as good as, or better, than competing national name-brand tools.

A single lever adjusts all four wheels on this 5-horsepower Ace self-propelled lawn mower. Features like this are usually found only on higher-priced machines.

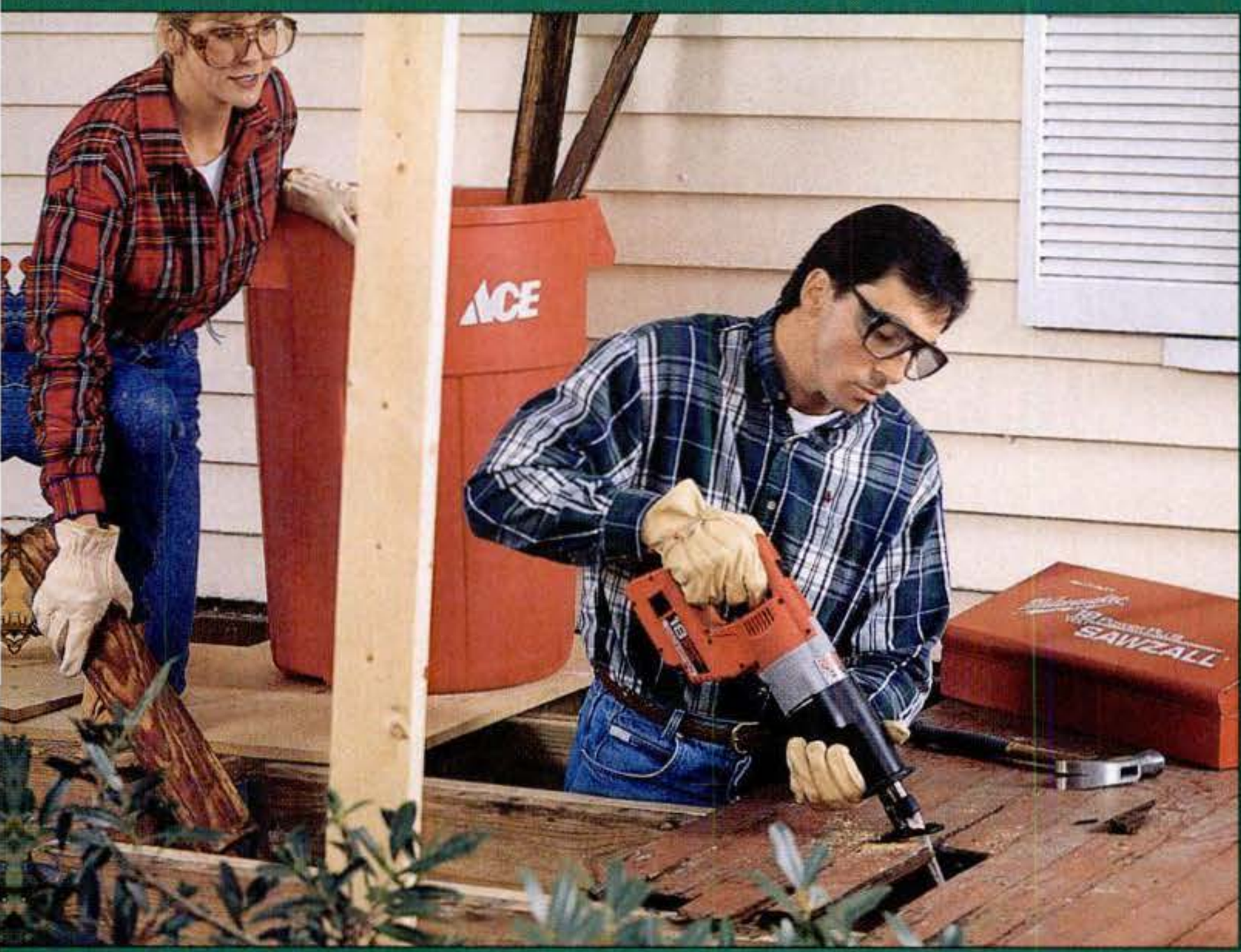
choice between quality and cost-efficiency can be difficult.

However, there is a low-cost, high-quality alternative to national brands when you buy tools, equipment, building materials and other hardware supplies for your home. Ace Hardware stores offer products in every major hardware category, and every Ace Brand product is certified by independent testing to be as good as—if not better than—the leading national brands. Our Ace lawn and garden hand tools, for example, have a lifetime warranty, and our satisfaction is guaranteed. It's also important to us that our local Ace store owner is always ready to help with advice and knowledgeable solutions, no matter what kind of job we're doing.

The biggest job waiting for us this spring was the reconstruction of our front porch deck. The old, untreated wood floor boards suffered badly this winter, and were severely damaged by water and weather. Spot repairs had been done before, but now the decking had to be removed completely and replaced with new wood.

When shopping for materials, we found plenty of options, but in the end our choice was clear—for our home, only

Copyrighted material



Renovation projects often call for specialized tools. This Cordless Sawzall can maneuver into difficult places when needed. Its 18-volt Power Plus battery and quick-charge system help speed the work.

critical to the successful completion of a project.

You don't need a new fence, yet.

Just new *Thompson's*® Fence Care.

So concentrated, it cleans and protects your fence for just pennies a square foot.

Now there's a quick and easy way to transform your dirty old fence. Thompson's® Fence Wash melts away grime and gray without scrubbing. Just spray on and rinse off. Then Thompson's® Water Seal® Fence Finish beautifies and protects, locking cedartone color in and water out. Finally, clean, renew and protect in one afternoon.

©1997 The Sherwin-Williams Company

JAN. 19	WALT DISNEY WORLD SPEEDWAY ORLANDO, FL	ESPN
MAR. 1	TUCSON RACEWAY PARK TUCSON, AZ	ESPN
MAR. 16	HOMESTEAD MOTORSPORTS COMPLEX HOMESTEAD, FL	TNN
APR. 20	PHOENIX INTERNATIONAL RACEWAY PHOENIX, AZ	TNN
MAY 3	PORTLAND SPEEDWAY PORTLAND, OR	TBS
MAY 10	EVERGREEN SPEEDWAY MONROE, WA	TBS
MAY 24	I-70 SPEEDWAY ODESSA, MO	TNN
MAY 31	NEW HAMPSHIRE INT'L SPEEDWAY LOUDON, NH	TNN
JUNE 6	TEXAS INTERNATIONAL RACEWAY FORT WORTH, TX	ESPN
JUNE 21	BRISTOL MOTOR SPEEDWAY BRISTOL, TN	ESPN
JUNE 29	NAZARETH SPEEDWAY NAZARETH, PA	CBS
JULY 5	MILWAUKEE MILE WEST ALLIS, WI	CBS
JULY 12	LOUISVILLE MOTOR SPEEDWAY LOUISVILLE, KY	CBS
JULY 19	COLORADO NATIONAL SPEEDWAY DACONO, CO	CBS
JULY 27	HEARTLAND PARK TOPEKA TOPEKA, KS	TNN
JULY 31	INDIANAPOLIS RACEWAY PARK INDIANAPOLIS, IN	ESPN
AUG. 9	FLEMINGTON SPEEDWAY FLEMINGTON, NJ	TNN
AUG. 16	NASHVILLE SPEEDWAY USA NASHVILLE, TN	TNN
AUG. 24	WATKINS GLEN INTERNATIONAL WATKINS GLEN, NY	ESPN
SEPT. 4	RICHMOND INTERNATIONAL SPEEDWAY RICHMOND, VA	ESPN 2
SEPT. 27	MARTINSVILLE SPEEDWAY MARTINSVILLE, VA	ESPN
OCT. 5	SEARS POINT RACEWAY SONOMA, CA	ESPN 2
OCT. 12	MESA MARIN RACEWAY BAKERSFIELD, CA	TNN
OCT. 18	CALIFORNIA SPEEDWAY FONTANA, CA	ESPN
NOV. 1	PHOENIX INTERNATIONAL RACEWAY PHOENIX, AZ	TBS
NOV. 9	LAS VEGAS MOTOR SPEEDWAY LAS VEGAS, NV	CBS

SCHEDULE TENTATIVE — SUBJECT TO CHANGE

THE NASCAR CRAFTSMAN TRUCK SERI
TOUGHNESS RIGHT OUT OF THE BOX.

THE NASCAR CRAFTSMAN TRUCK SERIES. ONLY ONE BRAND OF TOOLS IS TOUG

ENOUGH TO BRING IT TO YOU. AND ONLY ONE PIT BOX IS TOUGH ENOUGH TO HOL

THEM. MADE WITH HEAVY-DUTY, SLAM-SHUT CONSTRUCTION. SMOOTH-GLID

BALL BEARINGS FOR LONG LIFE AND DURABILITY. AND WITH OVER 21,000 CUB

INCHES OF DRAWER SPACE, STORAGE BY THE TRUCKLOAD. CRAFTSMAN PIT BOXE

AND THE NASCAR CRAFTSMAN TRUCK SERIES. THE TOUGHEST THINGS ON WHEEL

CRAFTSMAN®

MAKES ANYTHING POSSIBLE

Copyrighted material

© 1997 Sears, Roebuck and Co.

for this job was new Thompsonized Wood. It's not just pressure-treated, like the ordinary exterior-grade "green" wood available. Most people don't realize that pressure-treating protects wood from rot and insect damage, but does not prevent water damage. Thompsonized Wood adds a process that waterproofs the wood through and through, as well as providing protection against termites and rot. And only the highest quality lumber is used to prevent warping, splitting and twisting, so our deck will stay better-looking longer than if we had used any other pressure-treated exterior wood. Thompsonized Wood can also be color-stained using an oil-base Thompson's Water-Seal Stain or Wood Finish.

Renovation projects are always more difficult when you have to work in cramped quarters, with little room to maneuver heavy materials and bulky, demanding power tools. That's one of the reasons battery-powered tools have become so popular in recent years among tradesmen and home owners. With no entangling electrical cords to drag along, and with increased power and capability in today's best portable, rechargeable tools, you can get more work done in less time with far less effort.

ARROW® Introduces NEW

THE ATTACKER™

The Dual Purpose T2025™ Staple Gun That Attacks Almost Every Stapling Job!

SHOOTS FLAT CROWN STAPLES + SHOOTS ROUND CROWN STAPLES

ARROW T2025 brings you one of the most important advances in staple gun technology in decades — Its Built-In **STAPLE HEIGHT ADJUSTMENT GUIDE.***

The *revolutionary* guide is easy to use. Just lock it in position and your T2025 will shoot Round Crown Staples SAFELY over wire and cable up to 1/4" (6mm) in diameter. Reset the **Staple Height Adjustment Guide** to drive Flat Crown Staples deeper.

Arrow T2025...The ONE Staple Gun THAT DOES IT ALL! Arrow makes **4** different size Round Crown Staples, and **3** different size Flat Crown Staples for the new T2025. You work hard for your money. Spend it wisely.

The ARROW T2025 is available at Home Centers, Lumber Yards, and Hardware Stores.

ARROW®

ARROW FASTENER COMPANY, INC. 271 MAYHILL STREET, SADDLE BROOK, N.J. 07663 MADE IN USA
ARROW FASTENER (U.K.) LTD., 14 BARCLAY ROAD, CROYDON, SURREY CR0 1JN
JARDEL DISTRIBUTORS, INC., 6505 METROPOLITAN BLVD. EAST, MONTREAL, QUEBEC H1P 1X9

© 1997 ARROW FASTENER CO., INC.

*Patent Pending

When replacing decking, let the boards run long, then snap a chalk-line and cut off all of the ends on one pass. A Craftsman Sawmill Circular Saw has the power and performance to do a professional job.

For our deck's demolition and reconstruction, we relied on one of the most versatile power tools ever invented for this kind of work—the Milwaukee Sawzall reciprocating "bayonet" saw. But the tool we used, a new heavy-duty 18-volt Cordless Power-Plus Sawzall, offers more portability than even the original corded model. This tool's 2.0 amp-hour battery pack provides up to 36 watt-hours of cord-free cutting power, and an accompanying Power Plus II fast-charging unit restores the battery to full power in 40 minutes or less.

The Cordless Sawzall has almost too many features to name, including a Quik-Lok blade clamp for fast blade changes without tools, and up to 2000 cutting strokes per minute with full trigger-speed control. And it uses standard 1/2-inch-shank blades, which can be reversed for cutting upside-down in confined areas, as we had to do when working below the deck.

Because demolition is often a big part of remodeling, your number one rule should always be "safety first." Smart

Copyrighted material

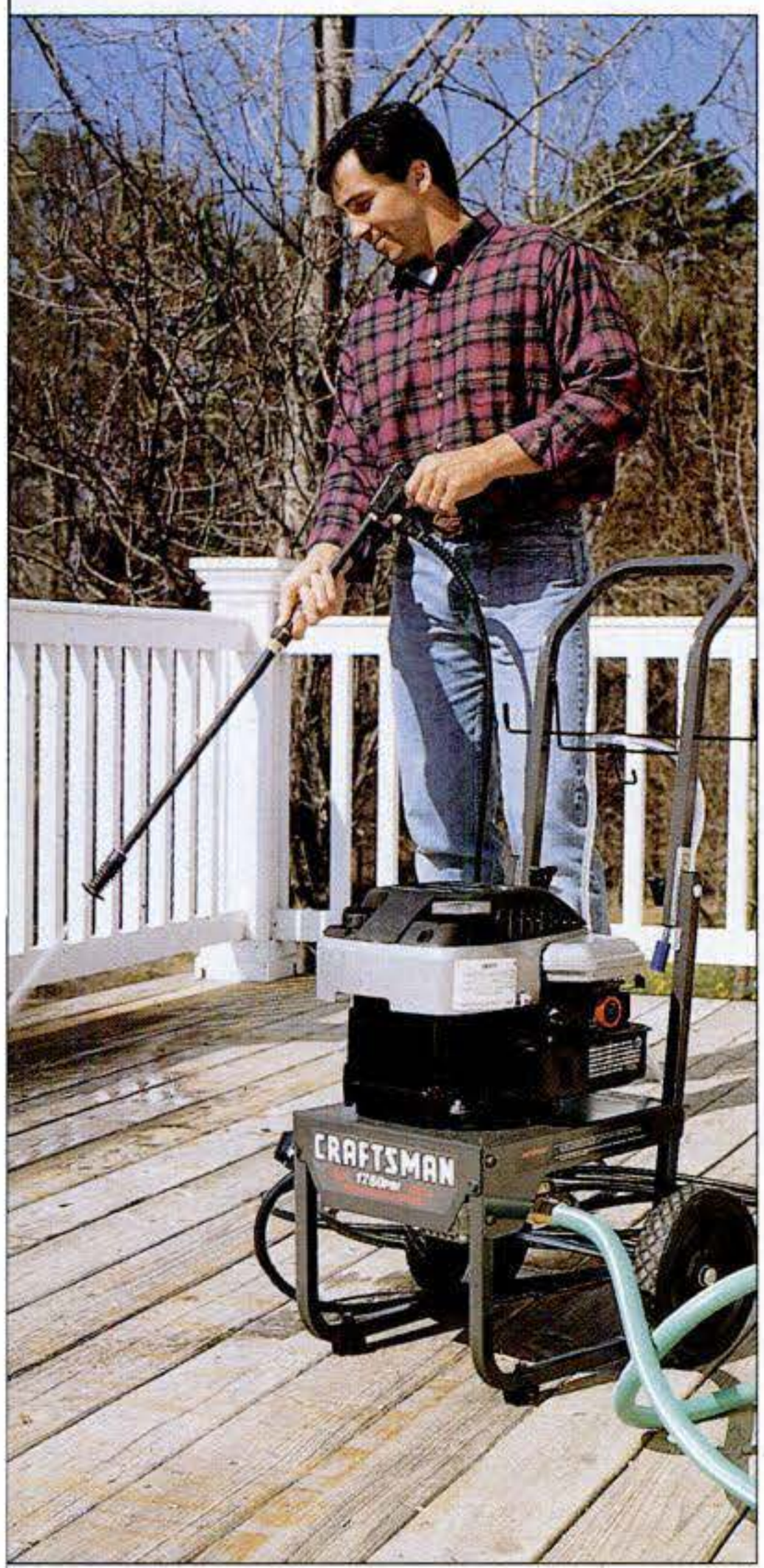
home owners can take a tip from the pros, who typically wear protective gear such as leather work gloves, hard-soled boots, eye protection and dust masks when doing tear-out prior to construction.

Another important safety aspect is the effect of physical stress during work, particularly repeated motion, on bones and joints. One result is that many tools are now "ergonomically" designed to fit the task and to prevent stress to the user.

A good example of a hand tool designed with ergonomics in mind is the Stanley Contractor Grade Jacketed Steel I-Beam framing hammer we used on this job. Its ribbed Dynagrip handle channels sweat away and allows better air circulation under the hand, and its 33-ounce high-carbon steel head is precision balanced for a smoother swing with less exertion. A key feature is its extruded steel I-beam construction, which offers maximum bend-strength and weight balance, along with a molded handle jacket for maximum overstrike protection and increased shock absorption. Demolition and construction is never easy, but with a tool as capable as this one, the work goes faster and with less effort.

Before we could begin tearing out the old porch deck to replace it, we first had to securely support the overhanging roof with temporary bracing, then remove the post columns and handrails. Ripping up hundreds of square feet of rotted decking is a dirty job, but one that goes quickly.

We used a new Craftsman 7 1/4-inch Sawmill Circular Saw equipped with a special carbide demolition blade for this work. A "demo" blade will cut through hardened knots, nails and even light



This Craftsman High Pressure Washer offers a wide range of power and spray settings for every washing chore, from blasting deck grime to washing cars.

THE FORECAST CALLS FOR HELMSMAN®.

Helmsman® Spar Urethane is a tough, clear finish specially formulated to protect against the changing elements. Wet or dry, hot or cold, Helmsman's flexible finish expands and contracts with the wood and resists fading, cracking and chipping. For exceptional beauty and protection, outside and in, count on Helmsman.

MINWAX HELMSMAN INDOOR/OUTDOOR SPAR URETHANE CLEAR GLOSS

MINWAX®

MAKES AND KEEPS WOOD BEAUTIFUL™
www.MINWAX.com

THE NEW YANKEE WORKSHOP PROUD SPONSOR

®Minwax and Helmsman are registered trademarks of The Thompson-Minwax Company
©The Thompson-Minwax Company

Copyrighted material

Work smarter, not harder, with the right tools. This Stanley Contractor Grade 33-ounce Jacketed Steel I-Beam framing hammer is ergonomically designed to transmit less shock and vibration to the user, and its patented handle-to-head assembly provides optimum overstrike protection.

HOME Remodeling IDEAS

Not all exterior woods—or tools are created equal.

metals like conduit where necessary, although you should always avoid such hazards if possible. Because our 2 1/2-horsepower, 13-amp Craftsman saw delivers a no-load speed of 5,000 rpm and has a maximum 2 3/8-inch depth of cut, sawing through not only the deck boards but also the deck's heavy framing timbers was no problem. Another feature of this saw is its redesigned, contoured handle and pommel grip, which provide better balance and helped make a tough job go fast and relatively easy.

Before we finished our porch project, we "blended in" the older, undisturbed materials surrounding our new deck by power-washing them with a Craftsman High Pressure Washer. This powerful yet portable 4.0-horsepower unit boosts an ordinary garden-hose stream of water to 1,750 pounds-per-square-inch (PSI) of pressure, while using only 2 gallons per minute (GPM). Its concentrated spray effortlessly cleaned away mold, mildew and surface dirt, and left our old decking and siding looking like new again.

Our "spring cleaning" efforts this year included two interior projects—creating a home office and adding an entertainment center to our family room.

Not all exterior-grade pressure-treated wood is the same. Thompsonized Wood has a factory applied waterproofing treatment, in addition to its resistance to rot and insects. Only high-grade lumber is selected to carry the Thompsonized Wood label. It's rated for ground-contact as well as general construction use.

New Craftsman Sawmill Circular Saws offer a more balanced grip and improved cutting ability, with all three 7 1/4-inch models increasing one full amp in power.

Constructing the freestanding, curved-top wet bar for our entertainment center was an easier project than it looks. We first built a simple framework from 2x3 lumber, then ripped 1/2-inch plywood into 3-inch-wide strips. Using drywall-type screws, we fastened four of these strips across the frame, spacing them equally from top to bottom. The thin plywood bends easily around the curved radius, but predrilling pilot holes for the screws is recommended. These strips provide a nailing base for the 5/8x4 vertical tongue-in-groove pine boards used to finish the bar front.

The bar top is a single piece of 3/4-inch oak plywood. To mark the radius, lay the plywood sheet atop the finished framework—with the better oak surface facing up—and scribe the curve from below. Turn the plywood over and use a jigsaw to cut to the line. Because jigsaw blades cut on the upstroke, this prevents splintering along the cut edge of the plywood's finished face. Sand the edge smooth and fasten the top from below with screws, being careful not to run the screws in too far and penetrate the surface. Use edge-banding or nail on a

Copyrighted material

In a durability test, the competitor's hammer lasted 60 seconds. If you happen to need one for longer than that, buy a Stanley hammer.

This picture tells the story better than any words can. In our overstrike tests, the Stanley hammer outlasted the competitor's brand by a 4 to 1 ratio.*

You see, after years of research (and a whole lot of sleepless nights) our engineering department concluded that jacketed, solid-core fiberglass is more durable than the compression-molded variety some of our competitors use to make their hammers.

That's the Stanley philosophy. Don't quit working until your product is perfect. You'll find this kind of dogged determination across the board at Stanley. In everything we make. Like a garage door insulated to reduce noise. Or a closet organizer made with steel planks instead of wire so it doesn't wrinkle your clothes.

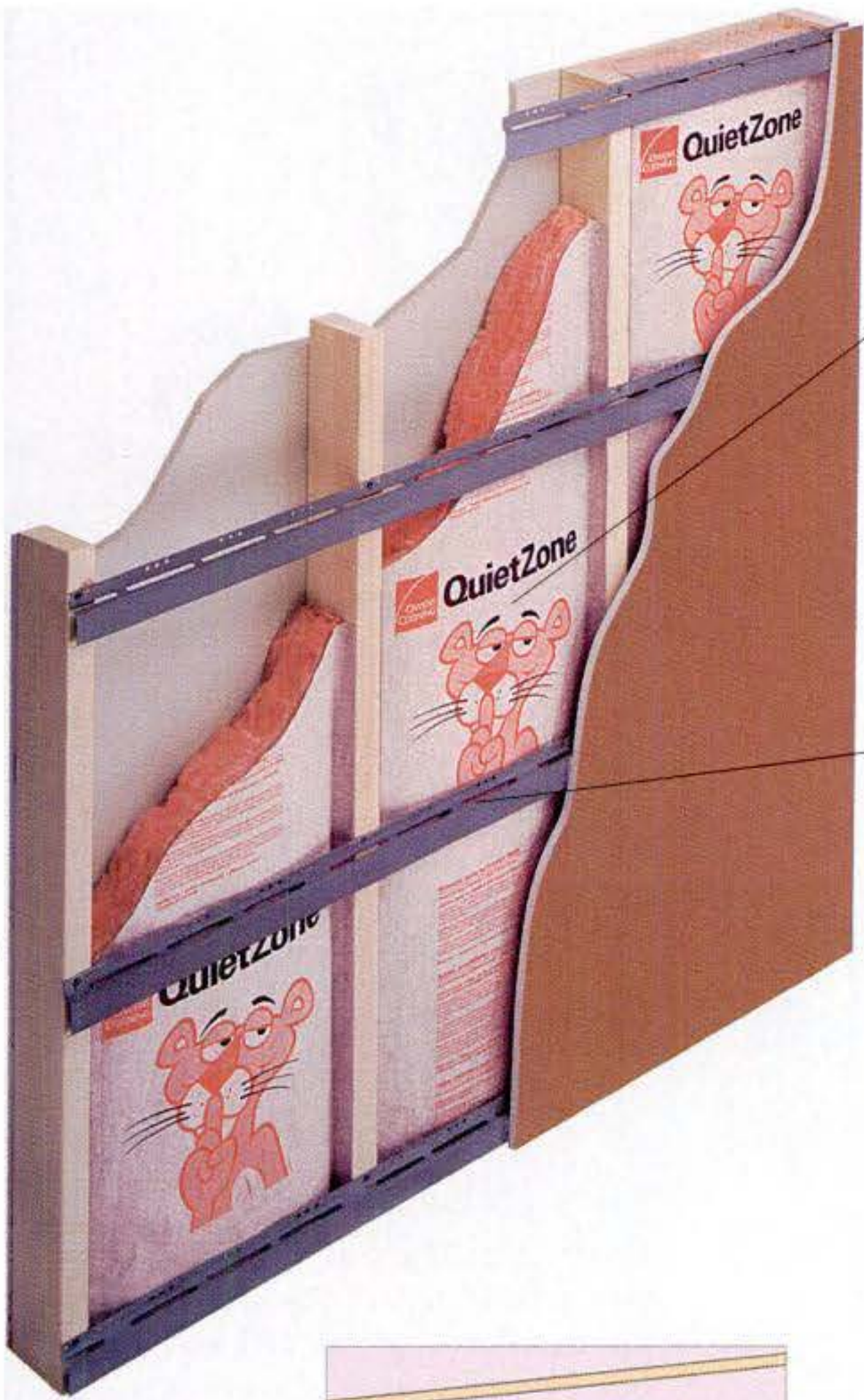
It's innovative thinking like this that's kept us ahead of the competition for more than 150 years. At Stanley we're not happy simply churning out products. We're only happy when our products are better than anyone else's.

STANLEY
helps you do things right.

*Overstrike test conducted by striking hammer handle against metal object. ©1994 The Stanley Works.

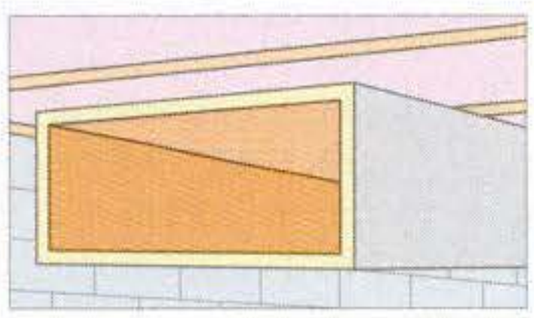
Life gets noisy.

We help keep it quiet.

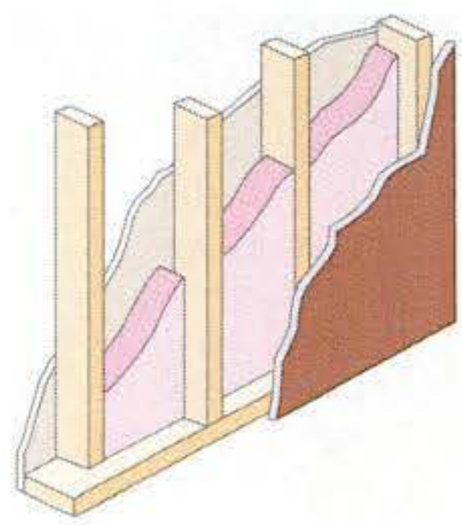


QuietZone™ Acoustic Batts
By simply adding sound-absorbing QuietZone *acoustic batts to a standard interior wall, you can substantially reduce noise transmission from room to room.*

Resilient Channels
For even more effective sound control, install these U-shaped strips called resilient channels. They keep drywall separated from wall studs to break up sound's vibration path and help prevent noise from spreading.



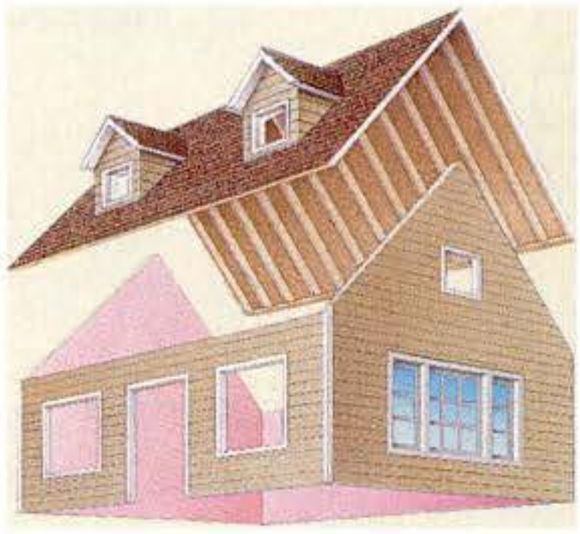
Owens Corning Fiberglas® Duct System
Owens Corning Fiberglas *ductboard not only stops the pops and pings of noisy metal ducts, it actually absorbs sound waves that travel along them.*



Staggered Wall Studs
Another way to enhance sound control is with staggered 2x4 wall studs. They interrupt sound's vibration path while providing more space inside the wall for things like bathroom plumbing.

After all, there's a system to these things.™
Your house is a series of systems. At Owens Corning, we want to help you understand how those systems work and how to make them work better. For free information or advice, call 1-800-GET-PINK

a.



b.

c.

d.

a. **Roofing System** – *Protects your home from the damaging effects of wind, rain, snow and sun.*

b. **Exterior System** – *Helps the outside of a house endure the elements beautifully, in trouble-free fashion.*

c. **Insulating System** – *Helps keep you warm in the winter and cool in the summer.*

d. **Sound Control System** – *Manages the flow and volume of sound. Lets you customize it.*

TM & © 1996 UAP

Each product in the Owens Corning Sound Control System is designed to turn down the volume on noise. And by combining our products and construction techniques, you can even customize sound control to each room's specific needs.

For more details, ask for our free 24-page booklet on *System Thinking for the Home*.™ Just call 1-800-GET-PINK or visit our web site at www.owenscorning.com

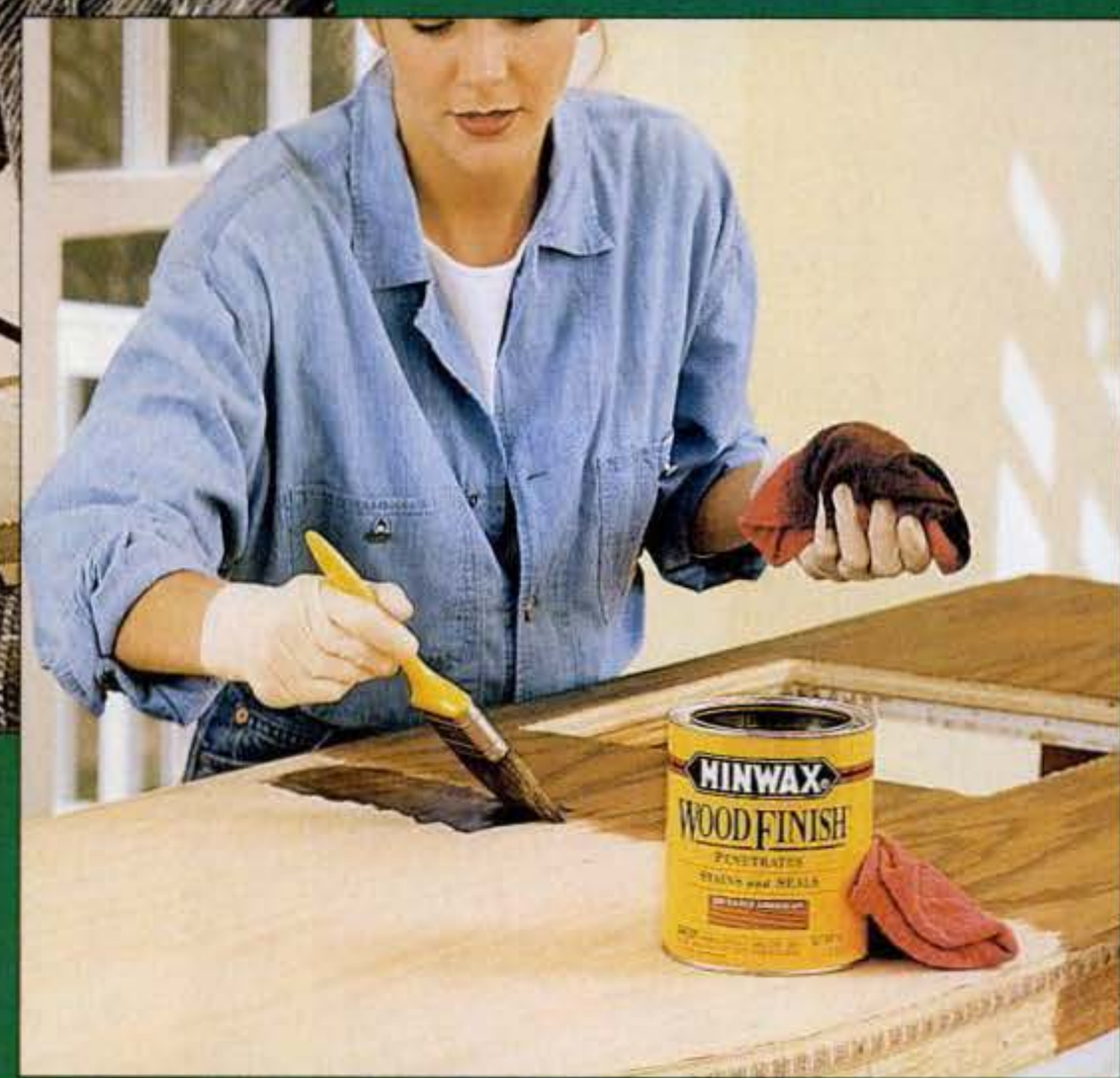
OWENS CORNING

SYSTEM THINKING *for the Home*™

The color PINK is a registered trademark of Owens Corning.
Pub. No. 19-RMP-21112A-PC06 Copyright © 1997 Owens Corning

Copyrighted material

Brush on, wipe off, and get the perfect depth of color with Minwax Wood Finishes. For a darker stain, reapply a second or third coat. Staining this oak plywood top is an easy two-step process.



HOME *Remodeling* IDEAS

In any project, it pays to choose the right

thin, decorative molding to cover the edge and hide the joint between top and bar front.

Having the right tools made constructing the bar even easier. Most of our cuts were done with a Skil Model 4445 Jigsaw, which has a powerful 4.0-amp variable-speed motor and four-position orbital cutting action. The orbital feature allows a user to "dial in" the cutting action of the blade, from a smooth vertical stroke for thin materials to a more aggressive stroke for thicker wood. Skil Jigsaws also offer Dynamic Vibration Reduction, which greatly reduces the "chatter" typically produced by these tools, and provides better user control with less fatigue.

We used another Skil tool, a Model 6250 variable-speed reversing 3/8-inch drill, to fasten the frame and top and bore pilot holes for the sink cutout. Also equipped with a rugged 4.0-amp motor, it has a conveniently positioned dial selector for low, medium or high speed ranges, and ball-bearing output for reduced bit wobble and better overall performance. Other welcome features in this drill include a keyless chuck and built-in level guide that make for accurate, effortless drilling.

Cutting curves in 3/4-inch oak plywood poses no problem for a Skil Jigsaw. Four orbital-action switch positions let users "dial in" an optimum blade stroke for thick or thin materials.

Use a spade bit to bore pilot holes for the bar top's sink cutout, then finish the opening with a jigsaw. This Skil 3/8-inch variable-speed reversing drill has a keyless chuck for fast bit changes.

Finishing the bar top was a quick two-step procedure, but the result looked like a professional job. Oak and other hardwood plywoods stain beautifully, unlike softwood or construction-grade plywoods, so it pays to choose the right materials from the start. That includes the finishing materials you choose as well. We picked a rich brown Early American Minwax Wood Finish, and followed it with two topcoats of Minwax Helmsman Spar Urethane. Minwax finishes are available in a wide choice of wood-tone colors, and can be depended upon for consistent, quality results.

After a quick touch-up sanding, our bar top was ready for staining. Apply Wood Finish with a clean, lint-free cloth or a brush, as we did. The speed and depth of stain penetration will vary in different woods, so test it first on a scrap piece or in an unseen area. It often helps to apply stain freely, wait a few seconds, then wipe off the excess to avoid too deep a color on the first pass. You can always repeat this process a second or even third time to get exactly the degree of color you want.

Copyrighted material

After the Wood Finish dries, use a natural bristle brush to apply one or two coats of Minwax Helmsman Spar Urethane. We picked a high-gloss finish for extra protection and shine on our bar top.

products.

Because a bar top gets lots of wear and is exposed to plenty of moisture from glasses and spills, we chose Minwax Helmsman Spar Urethane in a high gloss finish. This finish expands and contracts with the wood itself, so it provides exceptional surface protection and resistance to fading, cracking and chipping. Formulated for both outdoor and indoor use, Helmsman is ideal for any wood exposed to moisture, temperature extremes and direct sunlight, which makes it perfect not only for bar tops but also for doors, window trim and wood furniture.

In our home, creating a much-needed home office meant dividing the space in our large family room. Building a partition wall posed little difficulty, but ensuring that each room could function without interfering with the activity in the other was another matter altogether.

The problem, of course, is noise control. Fortunately, there are a number of strategies and building materials available that can help. One new product that effectively blocks sound within the wall itself is QuietZone acoustic batts from Owens Corning.

CUT THROUGH ANYTHING. ANYWHERE.

Milwaukee's new 18 Volt Power-Plus™ Sawzall® is the world's first full-size cordless reciprocating saw. It cuts through virtually everything. For more information, call 1-800-729-3878. It's what you need when nothing but heavy-duty will do.

Milwaukee®

MILWAUKEE ELECTRIC TOOL CORPORATION • AN ATLAS COPCO COMPANY

550-1656

Copyrighted material

ACE

Ace puts the red vest to the test

Can I add a mulching blade to my old lawn mower and recycle the cuttings?

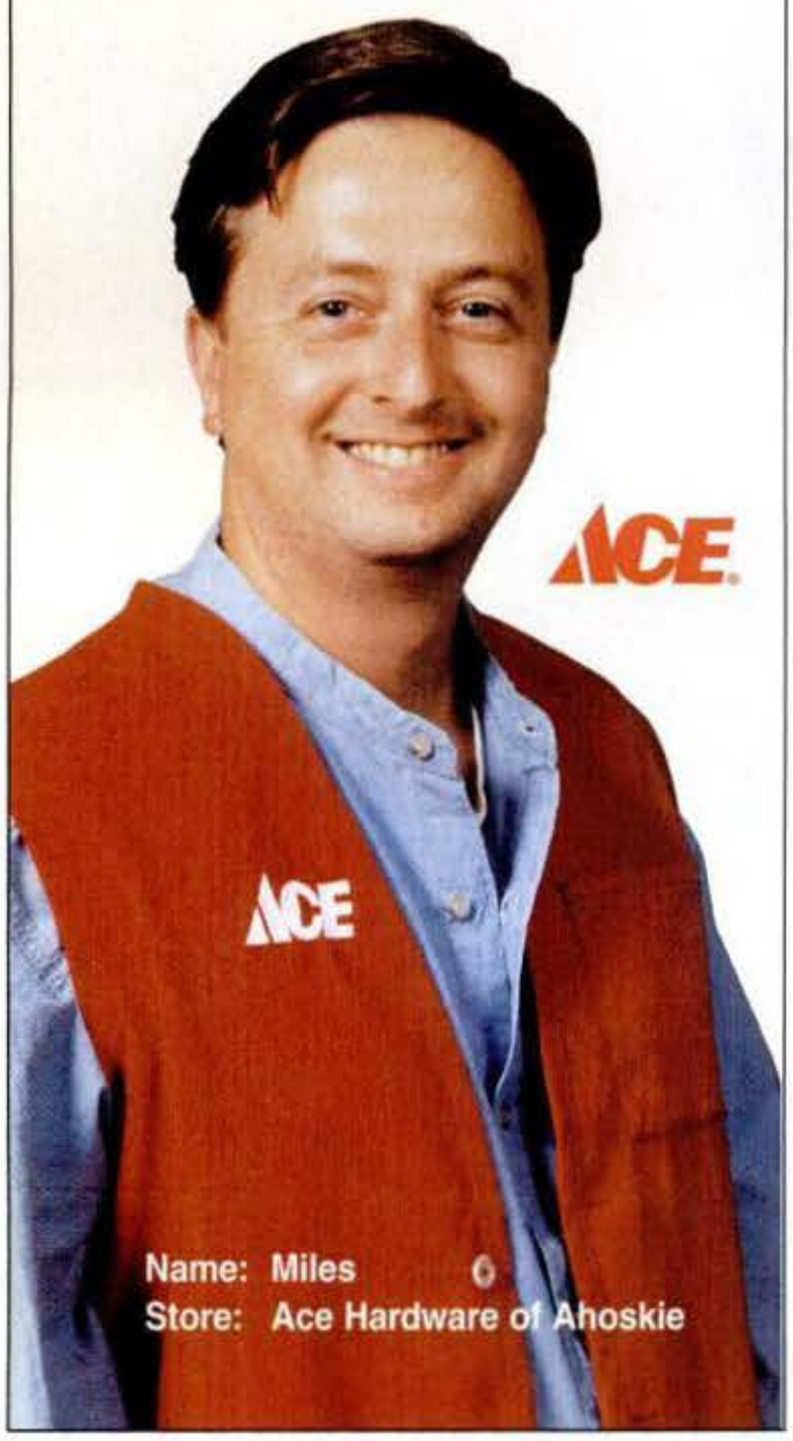
Retrofit mulching blades are available for most mowers, and may give you good results. New mowers have taller decks, specially designed blades and extra horsepower for optimum cutting and mulching performance.

We had several trees blow down in a recent storm. Can they be replanted?

If you get to it quickly, even a mature tree can be saved by digging out the crater and tipping it back into place. Carefully repack the roots, and stake the tree to support it until the roots grow in.

Rainwater pools around my downspouts are drowning my lawn. How do I fix this?

Short, fold-down extensions for your downspouts are often all you need to divert water away from the affected areas. If this isn't enough, attach 4-in. corrugated plastic drain pipe to the downspouts and run the pipes underground to a low point where the water can drain away.



SPECIAL ADVERTISING SECTION

A "sound" investment in your home.

When stapled between studs, the same way fiberglass insulation batts are installed in exterior walls, QuietZone acoustic batts create a barrier that absorbs sounds transmitted through the hollow wall cavities. To increase the batts' effectiveness, other measures such as caulking all openings and gaps, insulating pipes, and staggering back-to-back wall outlets are recommended for a systematic approach to soundproofing.

We also used resilient channels, a type of lightweight metal bridging used by professionals to separate the drywall from the wall studs, to prevent sound transmission through solid wall materials.

Another helpful item used in this project is an improved version of one of the most dependable and versatile tools anyone can own—a staple gun. But the new Arrow "Attacker" T2025 staple gun is unique in that it not only has a built-in staple height guide, but also shoots both flat crown and round crown staples.

Flat crown staples are used for general fastening, such as installing insulation

To block sound from adjoining rooms, install QuietZone acoustic batts between interior-wall studs. We attached the batt flanges with flat crown staples, using the new Arrow "Attacker" T2025 staple gun, and switched to round crown staples to install telephone and coaxial cable wiring.

For additional soundproofing, attach resilient channel strips across the studs, then attach the new drywall directly to the channels.

Copyrighted material

ACE®

When you don't exactly have a green thumb...

© 1997 Ace Hardware Corporation

see the folks in the red vest.

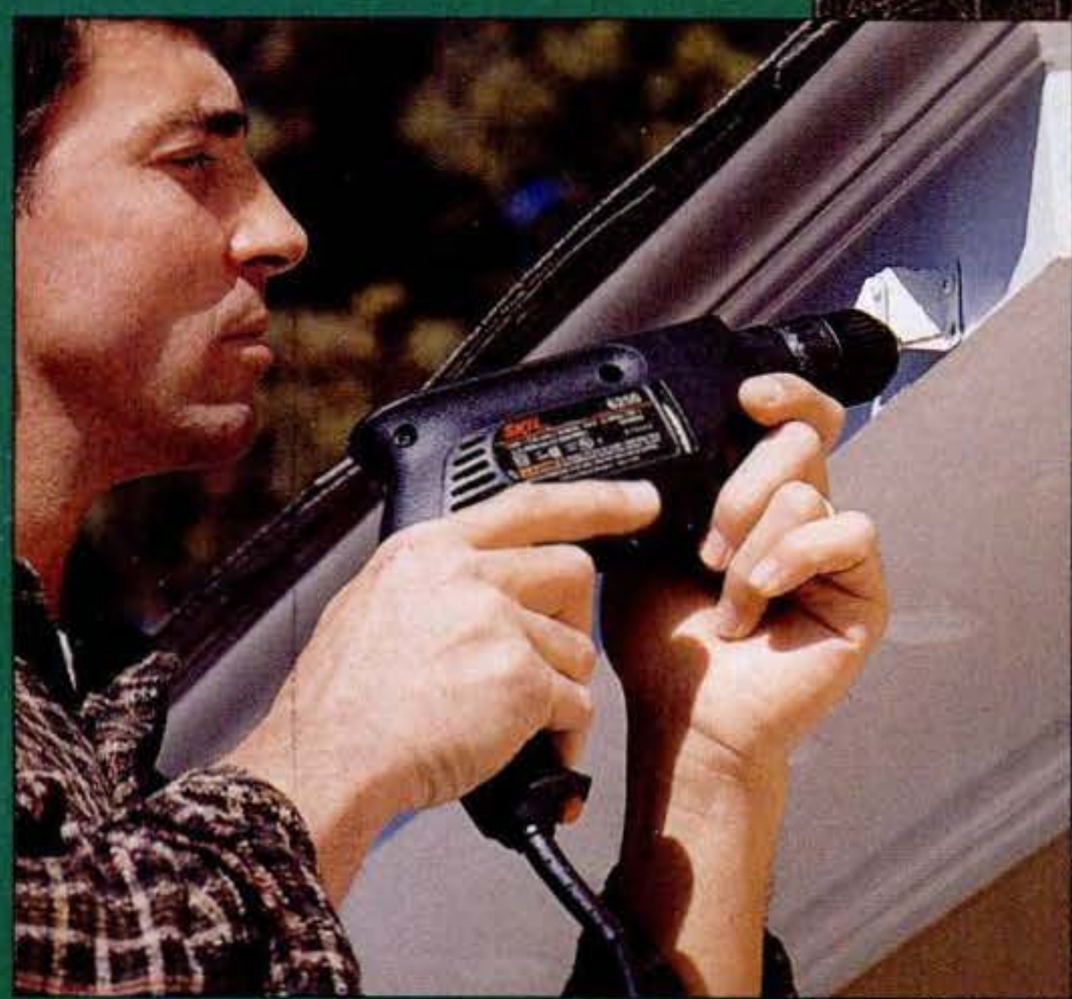
Margaret
Ace Peninsula Hardware

Whether you're trying to revive a patch of brown grass or grow some yellow squash, your local Ace dealer has all the advice and products you need to get started from the ground up. Including Ace Brand lawn and garden supplies with a complete satisfaction guarantee.

Ace is the Place on the Net @ www.acehardware.com

Proud Sponsor of This Old House on PBS

Copyrighted material



HOME *Remodeling* IDEAS

A smart way to "handle" rain and snow runoff.

or the acoustic batts we used, tacking carpeting and fabrics, repairing wire screens and other typical household chores. Round crown staples are used mainly to fasten wiring, including telephone, speaker and coaxial cable-TV wires, and staple sizes are available that correspond to different wire diameters.

On other staple guns, a separate wire-gauge accessory is necessary to prevent the staples from crushing the wires, and not all staple guns can use both types of flat and round crown staples. The T2025, however, has an integral adjustable nosepiece that can be quickly set, without tools, to safely fit wires from 1/8-inch (3mm) to 1/4-inch (6mm) in diameter. Four sizes of round crown and 3 sizes of flat crown staples are available for this indispensable tool.

Another seasonal task homeowners typically struggle with at this time of year is getting up on a ladder to clean out the gutters and downspouts. But this is one job we no longer worry about since we installed the Rainhandler Rain Dispersal System.

Rainhandlers are an easy to install, maintenance-free alternative to conventional gutter systems. These rugged, all-aluminum louvers replace gutter systems entirely. Because they don't have troughs or drainpipes to clog with leaves, twigs and other debris, they never need cleaning, and they're backed by a 25-year warranty. Rainhandlers are architecturally invisible when installed below the roof edge, where they intercept rainwater and snow-melt but do not catch it like gutters. Instead, the louvers break up the flow into rain-sized droplets and deflect those droplets away from the house walls. The water is dispersed over a wide area, watering plants and preventing erosion. And because Rainhandlers don't collect water, any debris that falls on the louvers is washed off or blown away by the wind. □

Our versatile keyless 3/8-inch Skil drill is handy inside and out for every drilling chore. We used it here to drill pilot holes for the brackets in our Rainhandler Rain Dispersal System.

The brackets go up quickly, and the 5-foot-long Rainhandler louvers simply snap into place. Installed in a continuous run below the roof edge, these sturdy all-aluminum louvers intercept rain water and melting snow and direct the droplets away from the house walls. Rainhandlers won't clog like gutters—leaves and other debris wash off or are blown away by the wind.

Graphic Design: WH$_2$P, Inc, Marketing Communications Wilmington, DE

Photography: Richard Haggerty Photography, Inc. High Point, NC

Writing: Mercurial Editorial Ossining, NY

Copyrighted material

PRODUCT INFORMATION

1. Ace Brand Products. We're making a name for ourselves by providing you with a low-cost, high-quality alternative to national brands. Each Ace Brand product is tested in independent laboratories before it is certified to be as good as, if not better than, the leading national brand. Over 7,000 items are available at participating Ace Hardware stores.

2. Wood Beautiful® Minwax® presents their all new 1997 WOOD BEAUTIFUL® magazine. WOOD BEAUTIFUL® contains 36 pages filled with exciting home improvement projects, decorating ideas, and expert tips and techniques designed to help you bring the beauty of wood into your own home. FREE. The Thompson•Minwax Company.

3. World's First Cordless Sawzall®

Milwaukee Electric Tool Corporation introduces the *world's first* Cordless Sawzall®. The Model 6516 Power-Plus 18-volt Sawzall combines convenience with cutting power. It allows users to reach difficult areas without the hassle of moving a power cord.

The Cordless Sawzall is constructed with an 18-volt Power-Plus battery motor, variable 0-2000 spm, and trigger speed control.

The Cordless Sawzall uses the Quik-Lok™ blade change system where the operator can insert and clamp saw blades without the use of a hex key.

4. To receive additional information on QuietZone™ acoustic batts or the Owens Corning sound control system call 1-800-GETPINK.

5. The Gutter Alternative. Patented, better than gutters, better than no gutters. On thousands of homes. No clogging, cleaning, or ground erosion. Rugged aluminum construction with a 25 year warranty. Free information. For more information, call 1-800-942-3004.

WEBSITE INFO

Ace Hardware	www.acehardware.com
Milwaukee Tool Corp.	www.industry.net/milwaukee
Minwax	www.minwax.com
Owens Corning	www.owenscorning.com
Rainhandler	www.rainhandler.com
Craftsman	www.sears.com/craftsman/
Skil Power Tools	www.skiltools.com
Stanley Tools	www.stanleyworks.com

6. The Craftsman Power and Hand Tools catalog features over 2,100 Craftsman tools available through the catalog by calling 1-800-377-7414 or at any Sears or Sears Hardware store.

7. 80 page full color catalog features complete line of Skil power tools and accessories plus listing of all factory and authorized service centers. For more information, call 1-800-301-8255.

8. To receive a free "Introductory Hand Tool Ergonomics" guide from Stanley Tools and the National Safety Council, or Stanley's ergonomically-designed products brochure, call 1-800-648-7654.

9. Thompsonized™ Wood combines CCA preservative treatment with high-grade lumber and built-in water repellent to provide dimensional stability and reduce warping and cracking. For more information, call 1-800-348-6804.

NAME

ADDRESS

CITY STATE ZIP CODE

Please send me the items circled at right: 1. N/A 2. Free 3. Free 4. N/A 5. Free 6. N/A 7. Free 8. Free 9. Free

Please send check or money order for $1.00 for shipping and handling to:

Popular Science
P.O. Box 5018
Pittsfield, MA 01203

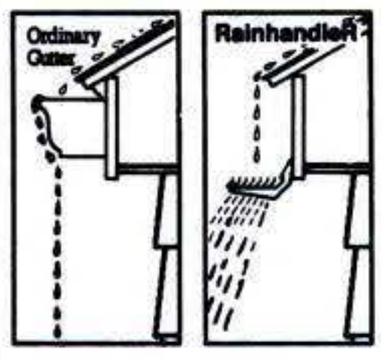
Allow 6-8 weeks for delivery

Popular Science June, 1997,Offer expires August 1, 1997

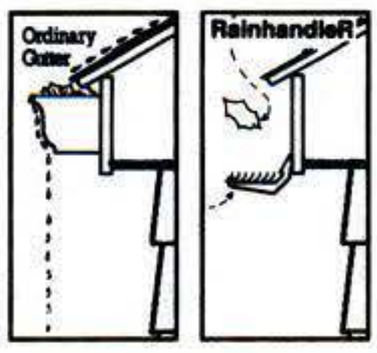
GET RID OF YOUR GUTTERS!

THEY CLOG, LEAK, FREEZE, RUST AND ROT.

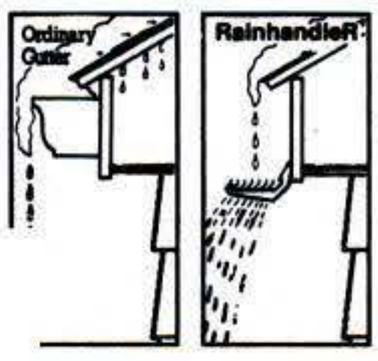
Replace them with the RAINHANDLER



STOP CLOGGING. **RainhandleR** needs no cleaning, because it can't clog. Its patented louvers break up roof water into a spray of tiny drops and disperse them away from your house.



STOP CLEANING. You'll never climb a shaky ladder again to clean a gutter. **RainhandleR** comes clean with a quick blast from your garden hose–from ground level.



STOP WATER DAMAGE. **RainhandleR** in winter, protects your investment by helping to prevent clogs and ice dams on the roof that otherwise lead to water rot and leaks.

RainhandleRs are installed on homes nationwide. They can be installed on yours in about 3 hours with a screwdriver. **RainhandleR** is virtually invisible, rustproof and comes in white, brown or natural aluminum. For more information send coupon to **RainhandleR** or call 1-800-942-3004; or FAX 1-800-606-2028 or E-MAIL: Rainhandle @ AOL.Com

Some distributor territories available

RAINHANDLER™

Dept.#PS067 from SAVETIME CORP.
2710 North Avenue, Bridgeport, CT 06604
Please send me your free information kit.

Name _____

Address _____

City _____

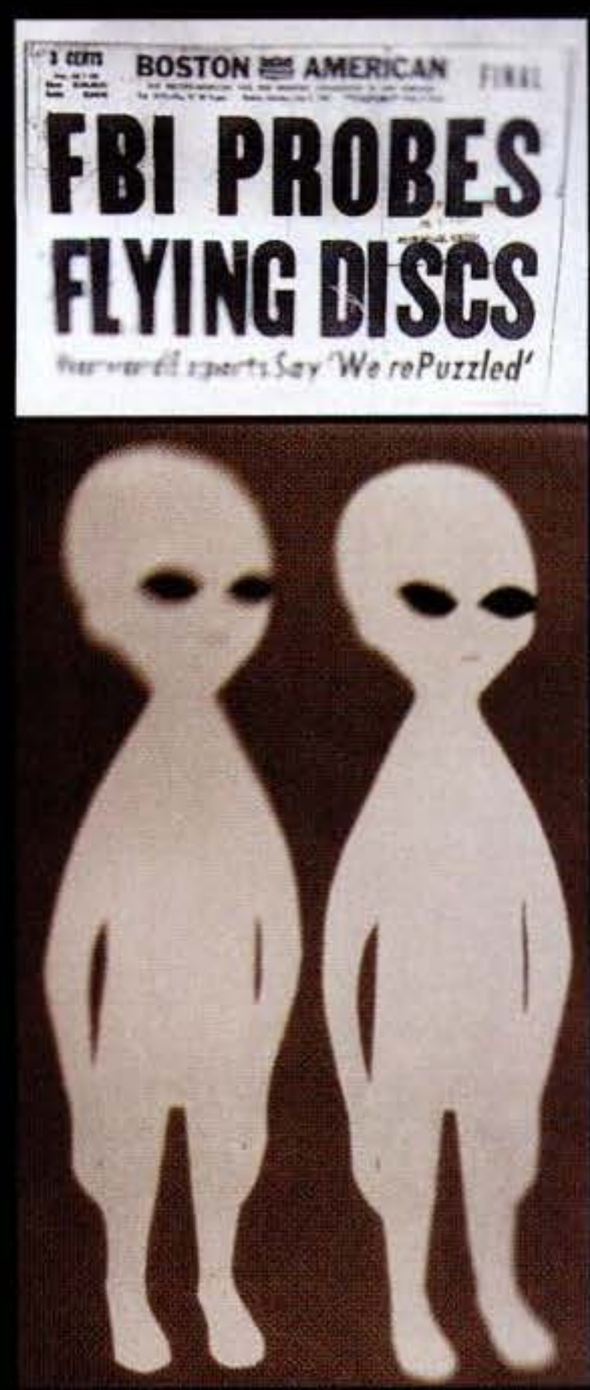
State _____ Zip _____

Phone ( ) _____

Copyrighted material

50 Years After Roswell

What crashed here in 1947 is a matter of dispute. But whatever happened then is good for business today.



ROSWELL AIRPORT, ROSWELL, NEW MEXICO

RAIN STREAKS THE WINDOWS of the 19-seat Mesa Airlines twin-prop as we touch down on one of the Roswell airport's three long runways. Built for the big military jets that once landed at a now-closed air base here, the airport is being eyed as a potential site for an all-night rock concert expected to draw as many as 150,000 people to this town of 50,000 on July 5. The occasion: the 50th anniversary of the Roswell "incident," the most legendary UFO crash of all time.

By Dawn Stover

The rock concert isn't the only event planned to commemorate the 1947 crash. The Roswell UFO Encounter '97 anniversary party planned for July 1 through July 6 will also include a UFO conference, a film festival, an alien costume contest, a "Crash and Burn Extravaganza" spaceship-building contest, laser shows at the local planetarium, and "Alien Chase" foot races. With 20,000 overnight guests expected, every motel in town is booked solid.

Roswell has become almost synonymous with flying saucers and aliens. Books, movies, and Web pages have spread the story of The Incident to the far corners of the Earth. Is there any truth to the tale? Photographer John Carnett and I spent three days exploring the Roswell area. We were looking for clues that could explain a mystery: What crashed here 50 years ago? And why did the government try to cover it up?

Copyrighted material

Visitors to the International UFO Museum and Research Center (below) can read old newspaper articles about aliens (below left) or see exhibits such as the mannequins (above) used in the Showtime movie about the 1947 "incident." A visit to Roswell wouldn't be complete without a trip to one of the alleged crash sites. At right is the massive rock that Jim Ragsdale claimed was split in two by a spaceship impact.

PHOTOGRAPHED BY JOHN B. CARNETT

Glenn Dennis (left) worked at the Ballard Funeral Home (above) in 1947. On July 7, he says, a man called to inquire about the availability of hermetically sealed baby caskets. Dennis also claims he saw shiny debris crammed into ambulances parked outside the Air Force Base hospital.

We soon learn that Roswell is a town with two of everything: two Texaco stations, two Denny's restaurants, two Best Western motels, two UFO museums, and two alleged UFO crash sites. Even the mayor has a twin. And there are at least two sides to The Incident: the believers who are convinced that extraterrestrials plummeted to their death near here in 1947; and the debunkers who insist that a top-secret government project was all that fell from the sky.

International UFO Museum and Research Center, Downtown Roswell

The early days of the Roswell Incident are chronicled on the walls of a converted movie theater that is now the largest UFO museum in town, welcoming more than 155,000 visitors since it opened four years ago. One morning in early July 1947, a ranch foreman named W. W. "Mac" Brazel found some odd-looking metallic debris littering a sheep pasture. The debris included thin fragments that Brazel claimed he couldn't cut with his knife or burn with matches.

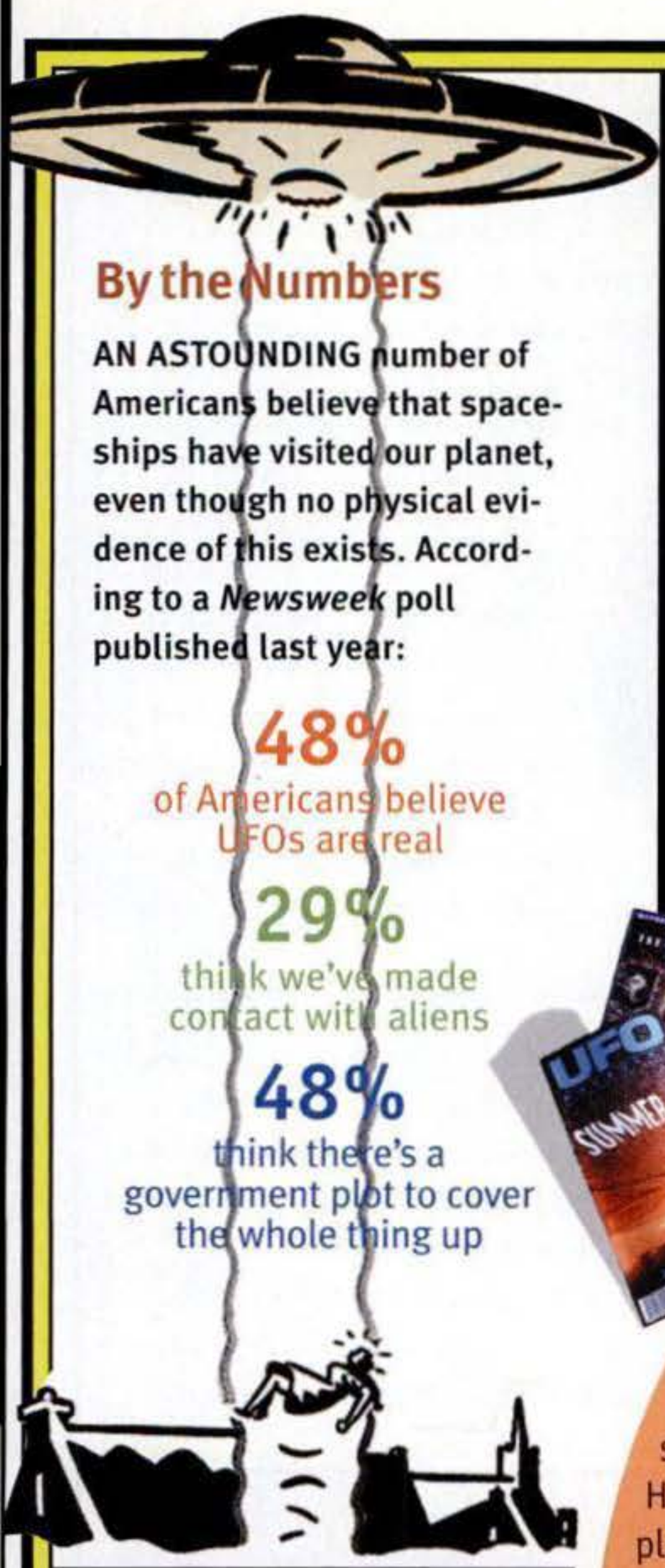
On July 6, at the urging of his neighbors, Brazel finally took some of his debris to Roswell—the nearest big town, but still about 75 miles away. Brazel presented the debris to the county sheriff, who then turned it over to officials at the Roswell Army Air Force base. The next day, Brazel led two intelligence officers to the ranch field where the debris was scattered. They spent all day picking up pieces and then headed for Roswell.

On the way back to the base, Major Jesse A. Marcel, the intelligence officer of the 509th Bomb Group based at Roswell (the other officer hasn't been identified), stopped at his house to show the debris to his wife and 11-year-old son. Jesse Jr., now a physician in Montana, says he remembers his father waking him late at night so that he could see pieces of a flying saucer: metal foil, chunks of what looked like Bakelite plastic, and a lightweight I-beam inscribed with purplish hieroglyphic-like symbols.

Marcel gave the debris to Roswell Base Commander Col. William H. Blanchard, who then summoned 1st Lt. Walter G. Haut., the base public relations officer. Haut is one of the few people directly involved in The Incident who is still alive.

Haut, who was 25 years old at the time of the Roswell Incident, told us that he never saw any of the reported debris from Brazel's field. But he vividly remembers Blanchard's orders: "Haut, put out a press release. Basically say

Copyrighted material



By the Numbers

AN ASTOUNDING number of Americans believe that spaceships have visited our planet, even though no physical evidence of this exists. According to a *Newsweek* poll published last year:

48%
of Americans believe UFOs are real

29%
think we've made contact with aliens

48%
think there's a government plot to cover the whole thing up

Alien Links

INTERNATIONAL ROSWELL INITIATIVE
http://www.roswell.org
The effort to get the U.S. government to clear up what really happened there in 1947.

MUTUAL UFO NETWORK (MUFON)
http://www.rutgers.edu/~mcgrew/mufon
An international organization that collects scientific data on UFOs.

NATIONAL UFO REPORTING CENTER
http://www.ufocenter.com
Logs, retrospectives, and briefs of UFO reportings.

SAUCER SMEAR
http://www.mcs.com/~kvg/smear.htm
An irreverent UFO newsletter with issues going back 43 years.

50 YEARS AFTER ROSWELL
www.popsci.com/roswell
More UFO and Roswell links, plus an alien scavenger hunt.

UFO ABDUCTION INSURANCE
http://www.gslink.net/~ufo
Beam me up. I'm covered for $10,000,000.

UFO Mania

A FEW MONTHS AGO, 39 members of the Heaven's Gate group committed mass suicide in the belief that a spacecraft traveling behind Comet Hale-Bopp would take them to another planet. On a "Nova" TV program last year, a middle-aged man claimed that aliens had removed his eye and extracted semen from his genitals. And on the World Wide Web, a California surgeon is described as having removed an alien implant from a woman's big toe.

Sounds crazy? Not to many Americans. In the 50 years since the Roswell Incident, and particularly in the last few years, extraterrestrials seem to have invaded not only the bodies of hundreds or thousands of Americans, but also the national consciousness. Here are a few indications of how pervasive UFOs have become in our culture.

Close Encounters of the Zero Kind

BETWEEN 1947 and 1969, the U.S. Air Force investigated 12,618 reported UFO sightings, reports the Pentagon. The USAF has since ceased its investigations, because it has not been able to find any evidence of extraterrestials or of exotic aircraft.

Screen Screams

NO DOUBT about it—most of us enjoy a good UFO story. The film *Independence Day*, which chronicles the invasion of Earth by a particularly malevolent fleet of aliens, grossed $733 million worldwide at the box office and is now available for home video. On the small screen, "The X-Files" routinely deals with UFOs and abductions by aliens. Last year's season premiere drew a 13.2 rating for its television audience, which means roughly 12.6 million people watched the show.

Aliens are everywhere—TV has "The X-Files," while *ID4* (bottom) hit theaters.

Identifiable Flying Objects

BEFORE YOU CALL the Air Force, police, or local paper about that weird-looking light in the sky, remember that the vast majority of UFO sightings, if investigated, turn out to be man-made or natural phenomena. These include:

- **Satellites and aircraft**
- **Weather balloons**
- **Meteorological phenomena, such as ball lightning and cloud formations**
- **The moon**
- **Venus, Mars, or other planets**
- **Bird flocks**
- **Meteors**

ILLUSTRATIONS: JASON SCHNEIDER (8)

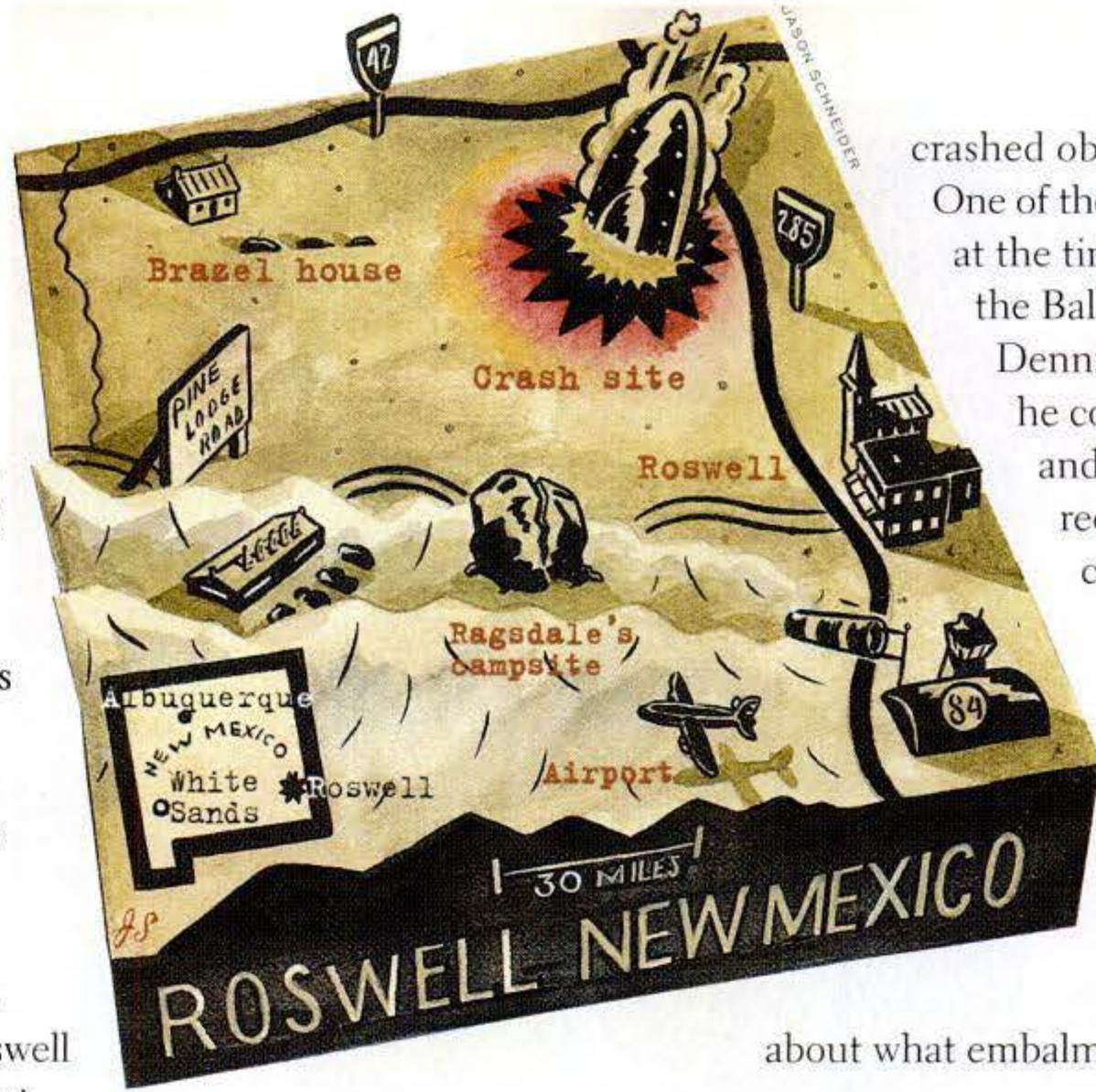
Copyrighted material

that we have in our possession a flying saucer."

Around 10:30 on the morning of July 8, 1947, Haut delivered the press release to the local newspapers and radio stations. *The Roswell Daily Record* for that day carried the eye-popping front-page headline "RAAF Captures Flying Saucer on Ranch in Roswell Region." Haut began getting phone calls from all over the world.

But no sooner was the story issued than it was retracted. On July 9, the Roswell paper ran a story saying that Brig. Gen. Roger M. Ramey—commander of the 8th Air Force headquartered in Fort Worth, Texas, where Marcel had been ordered to take some of the debris—had explained that the so-called flying disc was nothing more than a weather balloon. It had all been a case of mistaken identity.

Back in Roswell, not everyone was convinced that the crashed object was a weather balloon. One of the doubters was Glenn Dennis, at the time a 21-year-old mortician at the Ballard Funeral Home. We met Dennis at the UFO Museum that he co-founded with Walter Haut and Max Littell in 1992. Dennis recounted two unusual phone calls that he received on July 7, 1947. "The calls were from a guy who said he was a mortuary officer," recalls Dennis. "He said he needed to know how many two-foot-six-inch hermetically sealed baby caskets were in stock. Then he called back to ask about what embalming fluids would do to a body."



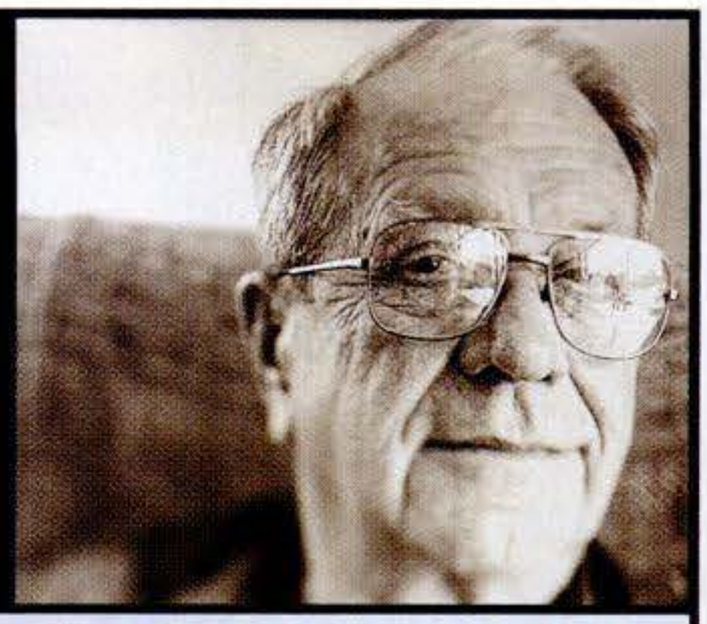
Within 75 miles of Roswell are the original debris site and two alleged UFO crash sites. All are located in sparsely populated areas.

Hub Corn's Ranch, 30 Miles North of Roswell

A trip to Roswell wouldn't be complete without a visit to all of the UFO sites. For a $250 fee, we hire Bruce Rhoads, a retired teacher who works as a volunteer at one of the UFO museums, to give us a tour in his Chevy Suburban.

Our first stop on the tour was a 24-square-mile sheep ranch owned by Hub Corn. His father bought the ranch from Florence McKnight in 1976, but not until 1994 did Corn learn that several people had identified his property

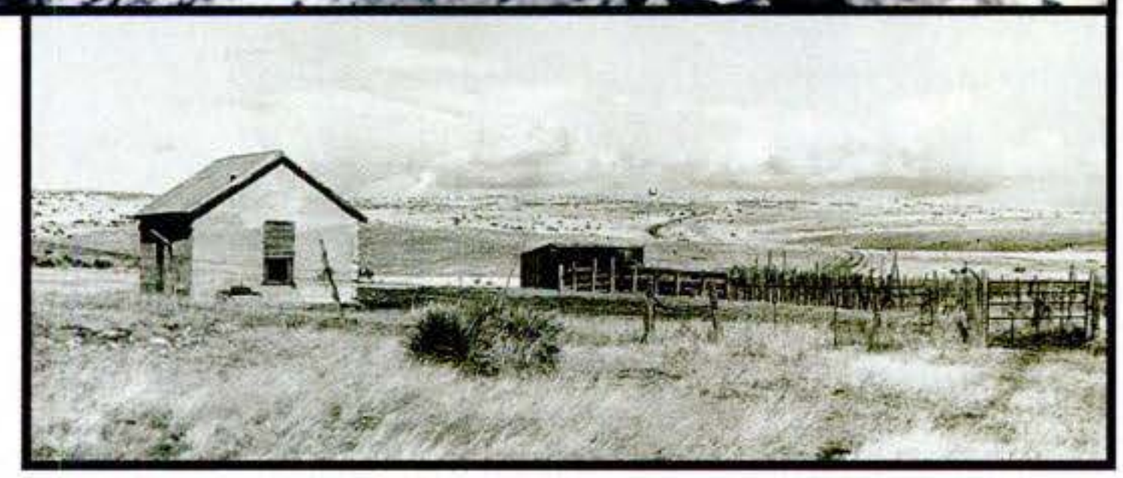
Haut remembers Blanchard's orders:
"Put out a **press release.**
Say that we have in our possession
a flying saucer."



Spaceship debris was allegedly stored in Hangar 84 (above). Walter Haut (top) wrote the bulletin saying saucer debris had been recovered.

Copyrighted material

New Mexico mud turns to pottery on the Chevy Suburban that Bruce Rhoads (below) uses to take visitors to Roswell's UFO sites. The original debris site is near an abandoned ranch house where Mac Brazel lived (below right). Debris was temporarily stored in the shed next to the house. One alleged crash site is at the base of a bluff on Hub Corn's ranch (right). The site is in dispute because the ranch's previous owners swear that no military cleanup crew was there in 1947.



as the site of a 1947 crash landing. Curiosity seekers began wandering onto the ranch, so Corn decided to start charging a $15 entrance fee. Since then, the ranch has become a popular tourist attraction. "People just want to be here," says Corn. "Some bring flowers, some cry when they see it."

We all walk down the quarter-mile trail to the crash site, at the base of a bluff running along a seasonal creek. "See those little American flags over there?" asks Corn, pointing to a couple of small flags protruding from the rocky face of the bluff. "That's where they found the spacecraft, tilted on its side." A second set of flags about 20 feet away marks the spot where an alien sat holding a black box, according to one account. Corn tells me that five bodies were eventually recovered from the site, along with a wedge-shaped ship.

Then again, just three weeks before our visit, Jim McKnight, whose aunt sold the ranch to Corn's father, signed an affidavit that hangs in the UFO Museum in Roswell. In the affidavit, McKnight says that his family owned the ranch in 1947, and that no military personnel ever set foot there to recover a spacecraft or any other debris.

Ragsdale's campsite, 50 miles west of Roswell

Suddenly, after all this time, a second crash site is identified. On a recently released videotape made just five days before his death in 1995, Jim Ragsdale says that he was trysting with a girlfriend in the forested El Capitan Mountains on the weekend of July 4, 1947. Lying "buck naked" in the back of his pickup truck, they heard a loud noise as a spaceship came crashing through the trees about 50 yards away. According to Ragsdale, the craft was damaged only slightly, although the impact split a large boulder at the site. On the videotape, Ragsdale says that he and his girlfriend crawled inside the craft and saw the bodies of aliens, their little seats, and a bejeweled instrument panel. Ragsdale says he and his companion fled the morning after the crash, when they saw military vehicles approaching the area.

Rhoads drives us to the impact site that Ragsdale identified from photographs. What we see is a seven-by-ten-foot rock split in two by an impressive crack. It seems unlikely, to say the least, that such a spectacular crash would not have been heard at Pine Lodge, a popular nightspot only a mile away that would surely have drawn a crowd on the July 4 weekend. (The log-cabin lodge has since burned to the ground.) And what guided those military vehicles to the mountain campsite within hours of the crash? Radar in those days only reached about 30 miles from the Roswell base.

It seems more likely that Ragsdale, a truck driver who admittedly drank a lot of beer that night in 1947, fabricated the story as a legacy to his grandchildren, who will receive a share of the profits from the videotape he made. Or perhaps in his last days he confused the spaceship crash with a plane crash that had occurred in the same area. In the 1940s, plane crashes were common in the mountains near Roswell.

Debris site, 75 miles northwest of Roswell

Ground zero in the whole Roswell story is the original debris site on the sheep ranch managed by Mac Brazel. The windshield wipers on the Suburban can't keep up with the onslaught of mud as we fishtail along the remote dirt roads leading to Brazel's two-room house, now abandoned. Next

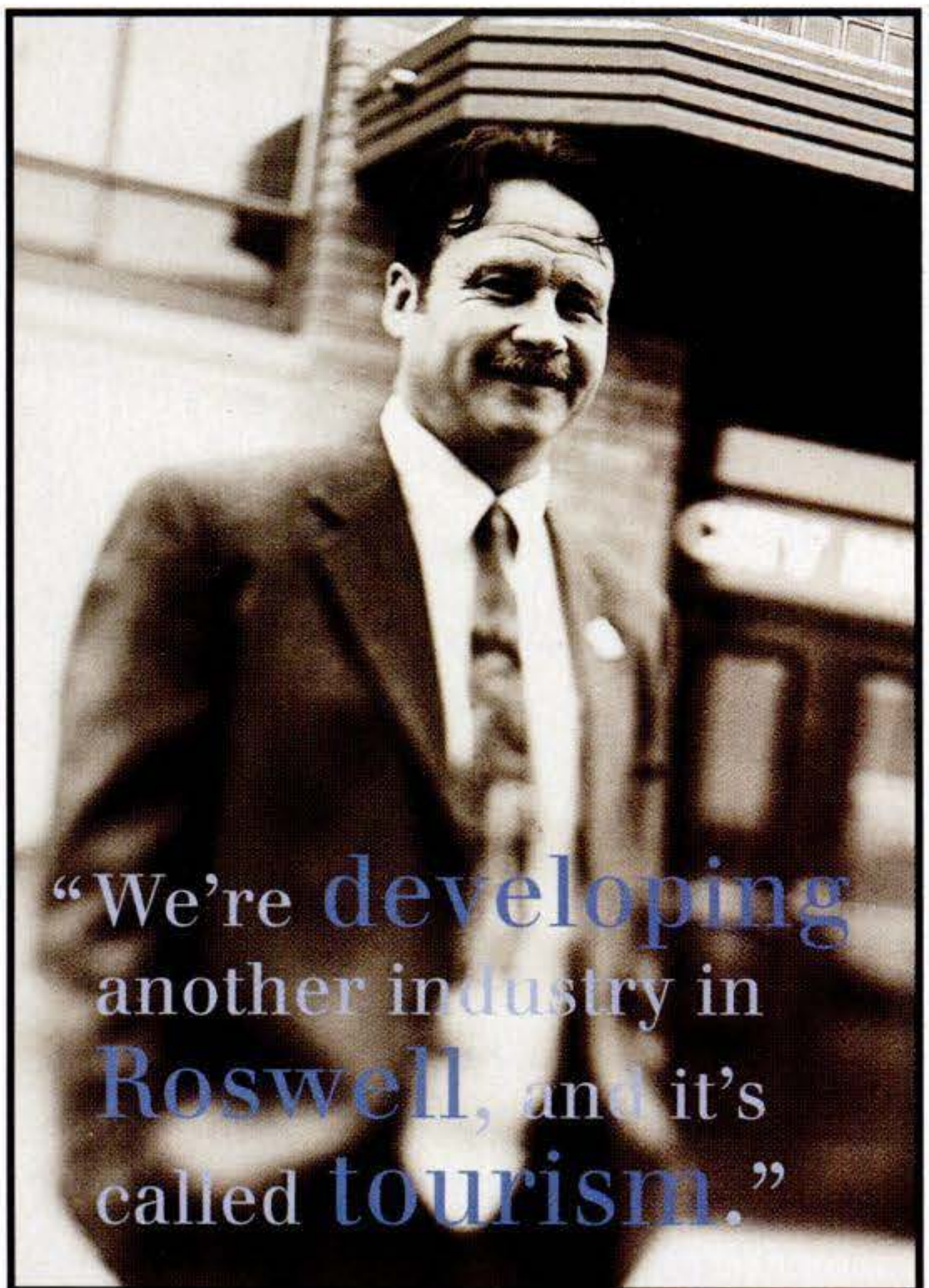
Copyrighted material

to the house still stands an old tin shed where debris was stored until military personnel arrived to haul it away. The field where the debris was found is about two miles away, in a treeless area of rolling hills. Although many UFO aficionados consider the event that took place here to be the best-documented case of an extraterrestrial encounter, not one scrap of physical evidence remains at the site or in the hands of witnesses. The military scoured the area for even the smallest fragments.

So why did the soldiers who were sent to clean up this area behave so strangely? People who lived in the area at the time claim that their travel was restricted, and that they were ordered not to talk about what they had seen.

The Pentagon now admits that General Ramey wasn't telling the whole truth when he said that the pieces found here had come from an ordinary weather balloon. Government officials now say that the debris actually came from a 700-foot string of weather balloons, radar reflectors, and acoustic sensors that was launched from Alamagordo Air Field, New Mexico, on June 4, 1947. The top-secret experiment was called Project Mogul.

Project Mogul was the brainchild of the late physicist Maurice Ewing, of Columbia University and the Woods Hole Oceanographic Institution. During World War II, Ewing discovered the existence of an ocean layer that could easily conduct the sound of underwater explosions for thousands of miles. Ewing speculated that a similar sound channel might exist in the upper atmosphere, and that detectors placed there might eavesdrop on Soviet nuclear detonations and even detect ballistic missiles screaming toward their targets. Project Mogul was designed to test Ewing's theory.



Roswell Mayor Thomas Jennings says UFOs are good for business.

Charles B. Moore, now a professor emeritus of physics at the New Mexico Institute of Mining and Technology, worked on Project Mogul as a graduate student at New York University in 1947. He says the balloon flights launched from Alamagordo in June and July of that year used as many as two dozen neoprene balloons in strings longer than 600 feet, with octahedral radar reflectors attached. The wreckage found near Roswell closely matched the Project Mogul material launched from Alamagordo, Moore says.

And remember those hieroglyphic-like symbols Jesse Marcel's young son saw? They bear a striking resemblance to the flower-like purple symbols on the tape that was used to reinforce the Project Mogul radar targets. Why the colorful designs? The targets were made by a toy company, which because of wartime materials shortages used novelty tape they had in stock.

Finally, in September 1994—at the request of New Mexico Congressman Steven H. Schiff—the government's General Accounting Office (GAO) released a "Report of Air Force Research Regarding the Roswell Incident," along with Pentagon documents that had been classified for 50 years. The only document GAO found linking UFOs and the Roswell Army Air Field was a classified report that said: "The Office of Public Information was quite busy during the month answering inquiries on the 'flying disc' which was reported to be in the possession of the 509th Group. The object turned out to be a weather balloon."

The report had been classified only because it mentioned the 509th Bomb Group, which at the time was the nation's only nuclear strike force—a fact that was a closely held secret. The *Enola Gay*, the plane that dropped the atom bomb on Hiroshima, was based in Roswell. In fact, the entire area around Roswell is sensitive. The White Sands Missile Range, where the first nuclear bomb was tested, is nearby and is still a weapons-testing site that is also used to stage war games.

City Hall, Downtown Roswell

The office of Roswell Mayor Thomas E. Jennings is decorated with stuffed aliens and UFO T-shirts. Hanging from the ceiling lamp is a small flying saucer.

"We're developing another industry in Roswell," Jennings tells me prior to our departure, "and it's called tourism." He estimates that some 25 percent of Roswell's motel bookings are for people visiting the museums and crash sites. The town has even created a new slogan to attract overnight guests: "Crash in Roswell."

To many businesspeople in town, it really doesn't matter what happened here 50 years ago. "It fell into our lap," says Jennings, "and we're trying to capitalize on it." ◆

Play our scavenger hunt game @ PopSci.com

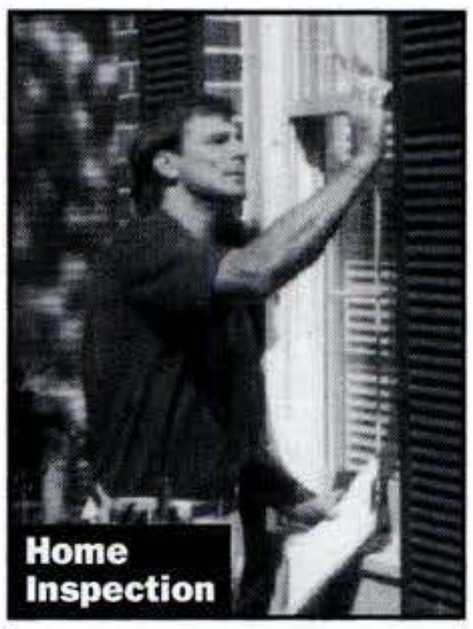
material

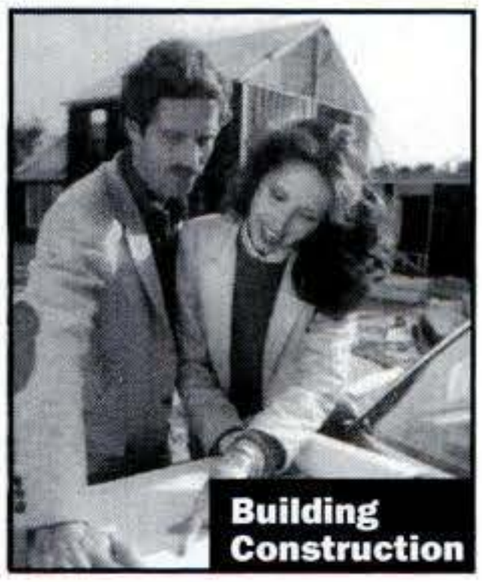
These services are needed in your town!

5 HOT BUSINESS OPPORTUNITIES

Train with NRI in your choice of five in-demand fields: Home Inspection ◆ Air Conditioning, Heating, and Refrigeration Locksmithing ◆ Building Construction ◆ Automotive Servicing

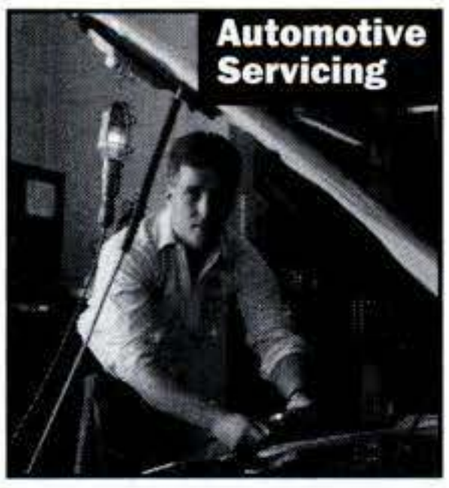
Everyone wants to get ahead, but many people don't know where to start. Let NRI show you the way — with five exciting opportunities that add up to good money, advancement on the job, even a business of your own! With NRI training, you start with the basics, then build your skills a step at a time, so you gain professional know-how through practical experience. And unlike other at-home training programs, NRI gives you the "tools of the trade" to train with and keep — just another great benefit of training the NRI way!


Home Inspection


Building Construction

Locksmithing

Air Conditioning, Heating, and Refrigeration


Automotive Servicing

Home Inspection

Cash in on the growing demand for home inspection services and earn good money whether you work full time, part time — even in a business of your own! With NRI training, you master every important phase of the home inspection process, using the tools that every successful home inspector needs — including a powerful 486DX2/66 MHz computer system with home inspection software and Quicken®! Get more details in NRI's free catalog — send for yours today!

Locksmithing

Start earning big money as a locksmith, even while you learn! With NRI's Master Locksmithing course, you get all the tools you need — including a professional Ilco 027A Key Machine — to make keys, repair and replace locks, install home security systems, and more! New expanded training includes automotive lock servicing and electronic security, making the opportunities for an NRI-trained locksmith even greater. Take the first step to success...send for your free NRI catalog right away!

Building Construction

You can make great money as a foreman, supervisor, or contractor in your own business with NRI training in Building Construction. NRI's easy-to-digest lessons and practical projects teach you the skills and professional secrets of carpentry, masonry, roofing, even wiring and plumbing. Plus, you'll actually frame a house in miniature — now that's hands-on experience! For more details, send for your free NRI catalog today!

Air Conditioning, Heating, and Refrigeration

With NRI training in Air Conditioning, Heating, and Refrigeration, you can land a good-paying job, pick up extra income in your spare time, or even start a business of your own. This course covers everything — from installing heat pumps to maintaining commercial refrigeration systems — while giving you hands-on experience with the very tools you'll train with and use on the job. You'll find more details in NRI's free catalog — send for yours today!

Automotive Servicing

You'll have no trouble getting your ASE certification once you take the course that Richard Petty, America's #1 stock car racer, calls the best of its kind. With NRI training in automotive servicing, you'll learn how to troubleshoot today's computer-controlled automotive systems — as you work with professional tools you'll use every day on the job. Whether you want to fix your own car or truck, or open your own shop, NRI prepares you for sure success in Automotive Servicing. Send for complete details today!

NRI can help you make it happen!

Whichever course you choose, you get everything you need to get started fast — the skills and know-how to do the job right, plus the tools and equipment you need to start your new career or get your business off the ground. And you always have the full support of your NRI instructor — even after you've completed your training! Don't wait another minute — send for your free NRI catalog today!

If another ambitious person has already sent in the coupon, write to NRI Schools, 4401 Connecticut Avenue, NW, Washington, DC 20008. Or...

CALL 1-800-321-4634, EXT. 2528

SEND COUPON TODAY FOR FREE NRI CATALOG

NRI Schools
4401 Connecticut Avenue, NW, Washington, DC 20008

✔ **Check one FREE catalog only**

- ❑ Home Inspection
- ❑ Locksmithing
- ❑ Building Construction
- ❑ Air Conditioning, Heating, & Refrigeration
- ❑ Automotive Servicing
- ❑ Small Engine Repair
- ❑ Electrician
- ❑ Gunsmithing
- ❑ Microcomputer Servicing
- ❑ TV/Video/Audio Servicing
- ❑ Computer Programming

Name _____ Age _____

Address _____

City/State/Zip _____

A Division of The McGraw-Hill Companies

Accredited Member, Distance Education and Training Council

0452-0697

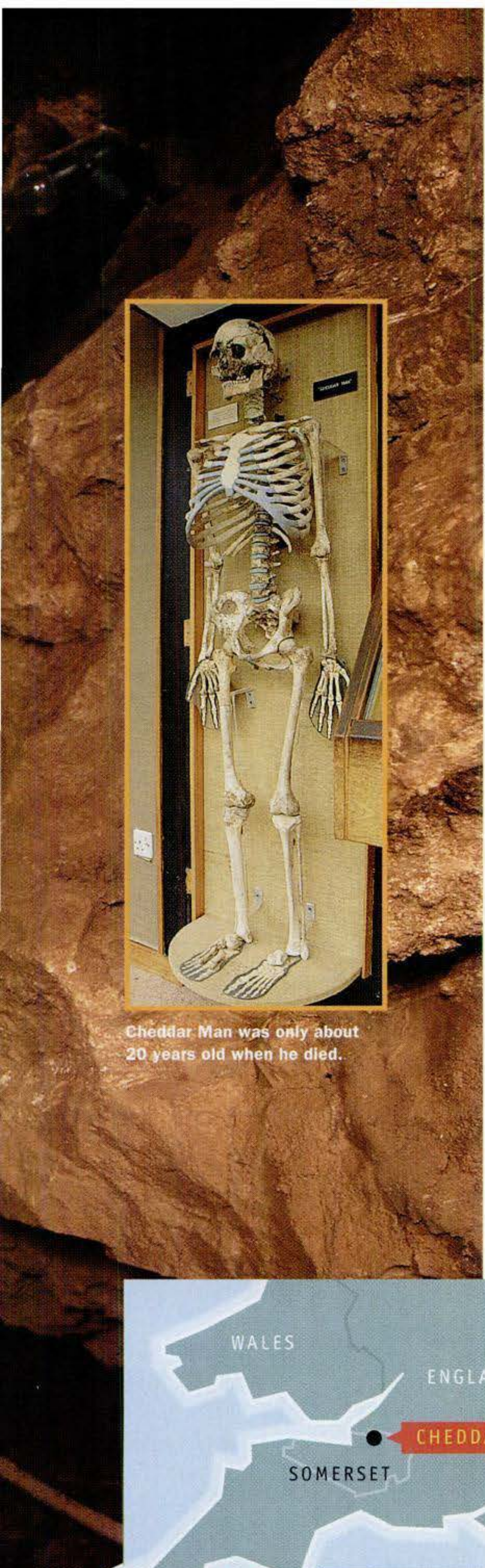
Copyrighted material

Stone Age Kin

Adrian Targett can trace his family tree back to a 9,000-year-old skeleton.

Adrian Targett and a cast of the remains of his 9,000-year-old relative, Cheddar Man. Scientists aren't sure what killed the ancient hunter.

Copyrighted material



Cheddar Man was only about 20 years old when he died.

DAVID KAMPFNER

INSET PHOTO: COURTESY OF THE MUSEUM OF NATURAL HISTORY

ADRIAN TARGETT TEACHES modern history, and now he has become part of it: Genetics testing recently revealed that the 42-year-old schoolmaster is related to a famous 9,000-year-old skeleton known as Cheddar Man.

Cheddar Man was a Stone Age hunter-gatherer. When he died, he was buried in a limestone cave in what is now the town of Cheddar, in southwest England. Ninety centuries later, a TV team making a local history program asked: Could there be a modern descendant of Cheddar Man?

To search for a genetic match, researchers from Oxford University and London's Museum of Natural History extracted DNA from a tooth cavity in Cheddar Man, and determined the sequence of base pairs—the chemicals that are the building blocks of the genetic code—in a section of the DNA. "By looking at the sequence," says Bryan Sykes, a human geneticist at Oxford, "we can easily see the relationships between individuals."

By Mariette DiChristina

After sequencing Cheddar Man's DNA, the researchers visited the Kings of Wessex School to obtain cell samples from children and teachers whose families had lived in the area for a long time. Toothbrush-like devices collected cells from the insides of the volunteers' cheeks.

Later, the TV crew returned with the news. Recalls Targett: "The announcer said, 'There is one match—and it's you!'"

The researchers used mitochondrial DNA, which is found in the energy-producing parts of cells and is easier to recover than DNA from the cell nucleus. "There's just a lot more of it," explains Sykes. Nuclear DNA—the type used in criminal cases like the O.J. Simpson trial—comes from both parents. But mitochondrial DNA is passed virtually unchanged from mother to daughter.

That means Cheddar Man and Targett shared a female ancestor. In the sequences of 300 base pairs that were compared, there was only one difference between the skeleton and the history teacher. "That's about what can be expected from natural mutation over 10,000 years," says Sykes.

Targett lives just a half mile from Cheddar Man's burial cave. "I've no knowledge that any of my ancestors lived here," he says, however.

Targett is probably not the only living relative of the 9,000-year-old skeleton. One percent of all Britons and many Europeans may be related to Cheddar Man, according to Sykes.

The research on Cheddar Man's genes strengthens the idea that modern Britons are descended from hunter-gatherers. Stone Age England was forested with fruit and nut trees, and had lots of game. "It was quite a pleasant environment," says Chris Stringer, a human origins researcher at the museum who collaborated on the work. Middle Eastern farmers brought agriculture—and their genes—to Britain about 6,000 years ago. But Britons like Targett are from far older stock. ◆

JOHN GRIMWADE

Cheddar Man's skeleton rested in Gough's Cave in Cheddar, England, until it was discovered in 1903 by workers digging a drain.

Copyrighted material

THE UNABRIDGED VERSION OF

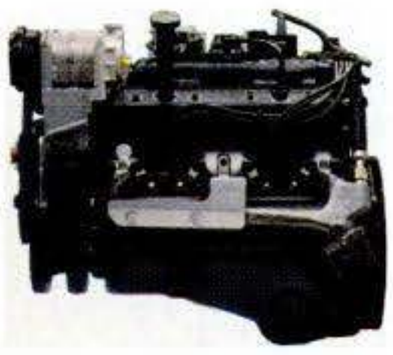
With an unedited interior volume of 178 cubic feet, the Yukon four-door is a definitive piece of work. And it's already getting excellent reviews.

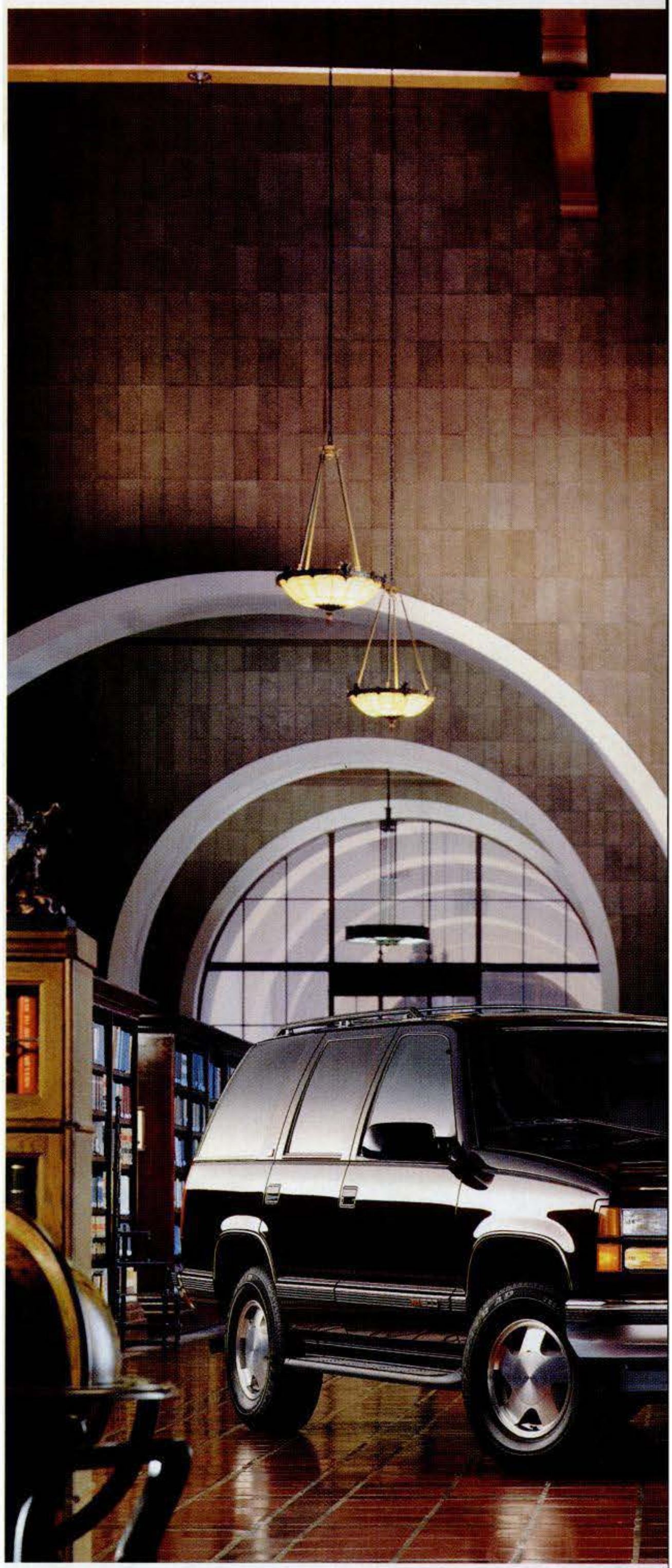
AN AWARD THAT SPEAKS VOLUMES.

J.D. Power and Associates has ranked Yukon the most appealing fullsize sport utility.* When owners of vehicles in the same class were asked to rate their vehicles on over 100 attributes, the GMC Yukon emerged on top.

AN INTRIGUING STORY OF POWER.

The Yukon has an exhilarating 255 hp engine, the most horsepower in the fullsize sport utility class by a wide margin.** With that much power, control is of the essence. Which is why the Yukon has an independent front suspension and a new electronic speed-sensitive steering system.





*Shown with available equipment. *J.D. Power and Associates 1996 Automotive Performance*
***Excludes other GM vehicles.* *©1996 General Motors Corporation. All rights reserved. GM, GMC*

Copyrighted material

THE SPORT UTILITY VEHICLE.

A SOPHISTICATED CHARACTER.

With standard four-wheel antilock brakes and available push-button four-wheel drive, it's easy to focus on the Yukon's rough and tumble capabilities. But inside, you'll find

the SLT is the picture of refinement. Extensive sound insulation. Leather seating surfaces. A concert-quality CD system. And

plenty of storage within the driver's reach. With all it has to offer, the Yukon is destined to become a classic. To learn more, browse our website at **www.yukon.gmc.com** or call us toll-free at **1-888-4A-YUKON.**

YUKON

GMC COMFORTABLY IN COMMAND™

Execution and Layout (APEAL) Study.™ Study based on a total 25,492 consumer responses.
Yukon and the GMC logo are registered trademarks of General Motors Corporation. Buckle Up, America!

Copyrighted material

A Shock for Sharks

Swimming near a great white shark

J. D. WATT/NO YOUNG PRODUCTIONS

SHARK! For a diver, no word generates a rush of adrenaline—and terror—faster. But a new electronic device called Shark POD tips the balance of power in man's favor, allowing uncaged divers to swim safely near the sea's most infamous predator.

Shark POD (protective oceanic device) is an electronic shark repellent. The main neon-yellow body of the device straps to a diver's oxygen tank, and a lightweight "foot probe" straps to one of the fins. The two electrical transmitters are cabled together and are powered by a small rechargeable nickel-cadmium battery that fits inside the main body. A second cable with an on/off switch straps to the diver's chest or wrist, and LED indicators on the switch show when the power is on or the battery is running low. When fully charged, the battery lasts about 75 minutes. (A separate charger is included.)

By Chris O'Malley

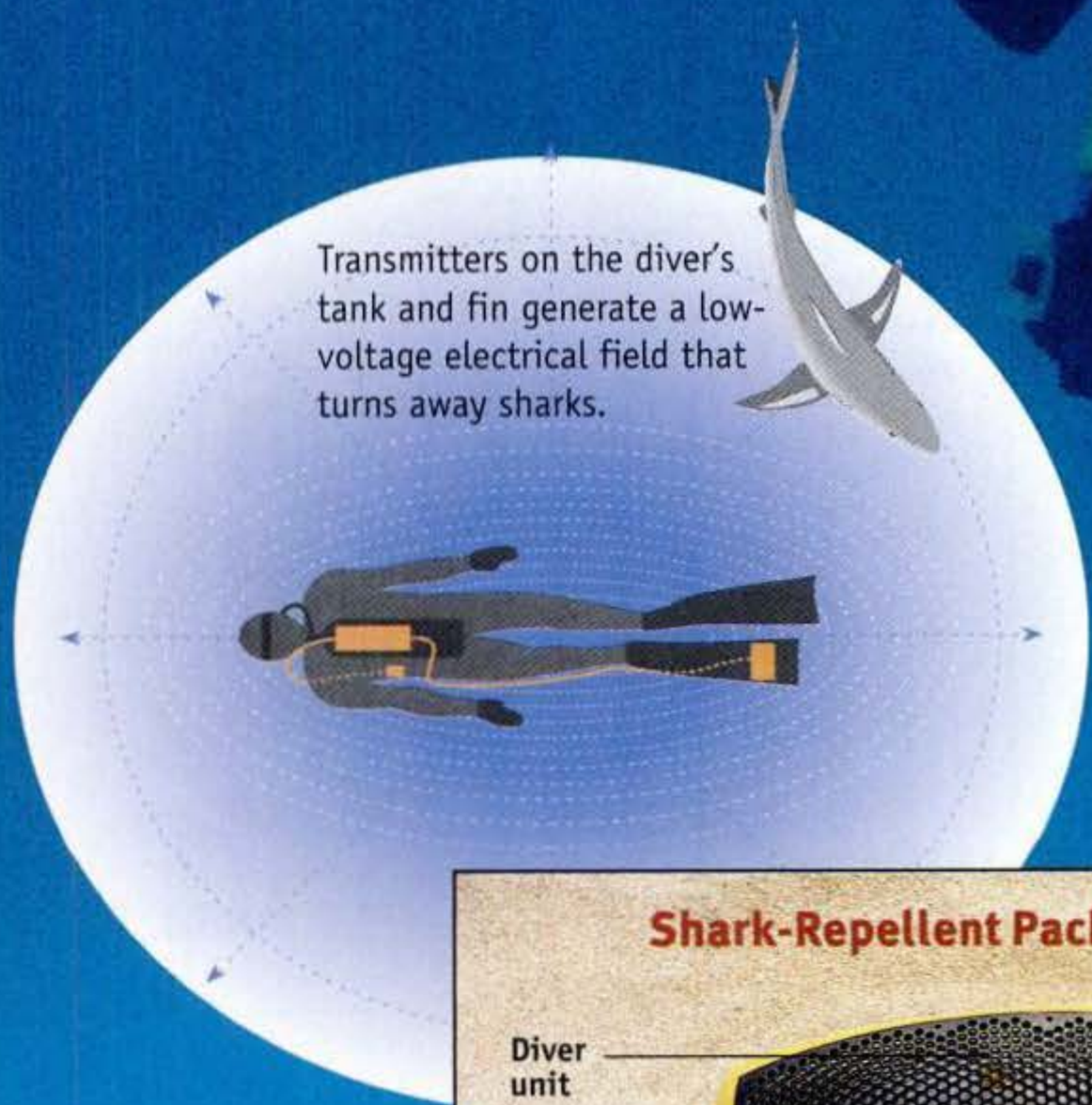
Once activated, the body and foot transmitters generate a low-voltage electrical field that extends 12 to 20 feet from the diver in all directions [see illustration], aided by the natural conductivity of salt water. The strength of the DC charge is only about one-quarter that of an electrified cattle prod, and it apparently neither injures the shark nor affects other sea life or the diver (though you can feel a mild shock if you get very close to one of the transmitters). But it's enough of an irritant to make sharks literally turn tail and quickly dart off.

Exactly why Shark POD works remains a bit of a mystery. Scientists know that sharks have pores on their snouts that can detect electrical signals of extremely low voltages—as low as a fish's heartbeat—which are believed to help them locate prey. But whether it's these very sensitive pores, other pores on the shark's body, or another sensory system that picks up the Shark POD's charge is uncertain. Testing to date by divers, including renowned shark film makers Ron and Valerie Taylor, shows Shark POD works especially well with more aggressive sharks, such as great white, bull, and tiger sharks. Even when drawn close with bait (which is definitely not recommended), sharks rapidly veer away when the system is turned on.

Shark POD, developed by the respected Natal Sharks Board, a South African research organization, is now available at some U.S. dive shops. (Call Shark POD USA at 800-353-0217.) Prices range from about $650 to $1,000. The U.S. Navy and Coast Guard are among the interested customers. A version of Shark POD to be built into surfboards is in development now. The technology is also being adapted for life preservers, boats, and swimming area protectors. ◆

Copyrighted material

no longer means becoming his lunch.



ALEX MEARDON

The Odds of an Attack

WHEN IT COMES to shark attacks, the fear usually far exceeds the reality. Statistically speaking, you're 30 times more likely to die from a lightning strike than from a shark attack in the United States. And you're much more likely to be hurt or killed driving to the beach. Here's the recent history of shark attacks worldwide:

YEAR	TOTAL ATTACKS	FATALITIES
1990	39	3
1991	34	3
1992	50	5
1993	52	13
1994	61	7
1995	72	11
1996	36	2

Source: International Shark Attack File, compiled by the American Elasmobranch Society and Florida Museum of Natural History.

PHOTOGRAPHED BY JOHN B. CARNETT

VERGE MAGAZINE

ESSENTIAL GEAR for REAL LIFE

From Ragtops to Laptops, From Microbrews to Running Shoes, From Contour Skis to SUVs -

THE PRACTICAL GUIDE TO PERSONAL TECHNOLOGY

Here it is...

the newest magazine that gives you all the latest info on the absolute coolest stuff... web tv, cell phones, extreme wear, making money, fitness equipment, cars, home theater, the works!

Get It Now! Call 1-888-77-VERGE

Brought to you by Popular Science

name _____

address _____

city / state / zip _____ 5JPS2

VERGE MAGAZINE
PO Box 51145 Boulder CO 80323-1145

- ❑ **4 issues of VERGE for $11.97** (25% off the newsstand price)
- ❑ **8 issues of VERGE for $19.97** (37% off the newsstand price) ← best deal

Applicable sales tax will be added. Please allow 4-6 weeks for delivery of first issue. Foreign orders add $8 per year. Canadian orders add $7 per year for postage and GST.

Copyrighted material

Electric Tales

By Frank Vizard

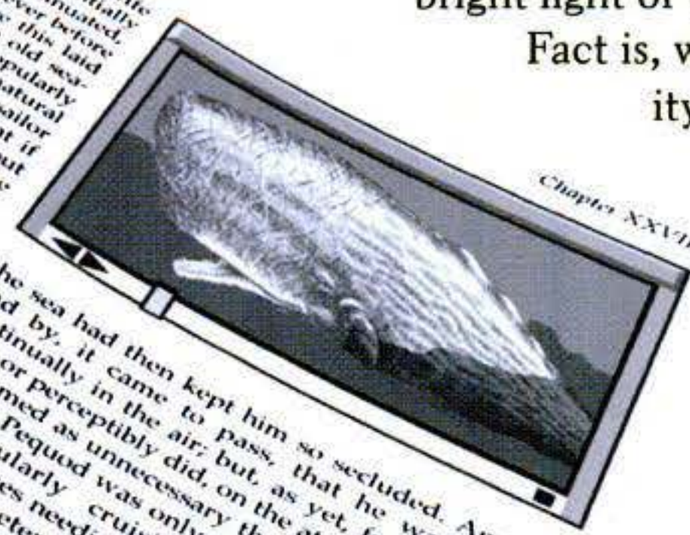
Computer chips replace wood chips in the pages of 21st century books.

ILLUSTRATIONS BY SLIM FILMS

IT MAY BE the last book you'll ever buy. And certainly, from a practical standpoint, it will be the only book you'll ever need. No, it's not the Bible or some New Age tome promising enlightenment—although it would let you carry around both texts simultaneously. It's an electronic book—a single volume that could contain a library of information or, if your tastes run toward what's current, every title on today's bestseller list. And when you're done with those, you could refill it with new titles.

Why an electronic book? Computers can store a ton of data and their laptop companions make all that information portable. True enough. But laptops and similar portable information devices require a lot of power—and heavy batteries—to keep their LCD screens operating. And LCDs are not easy to read in the bright light of the sun.

Fact is, when it comes to portability, easy viewing, and low power requirements, it's hard to beat plain old paper.



Copyrighted material

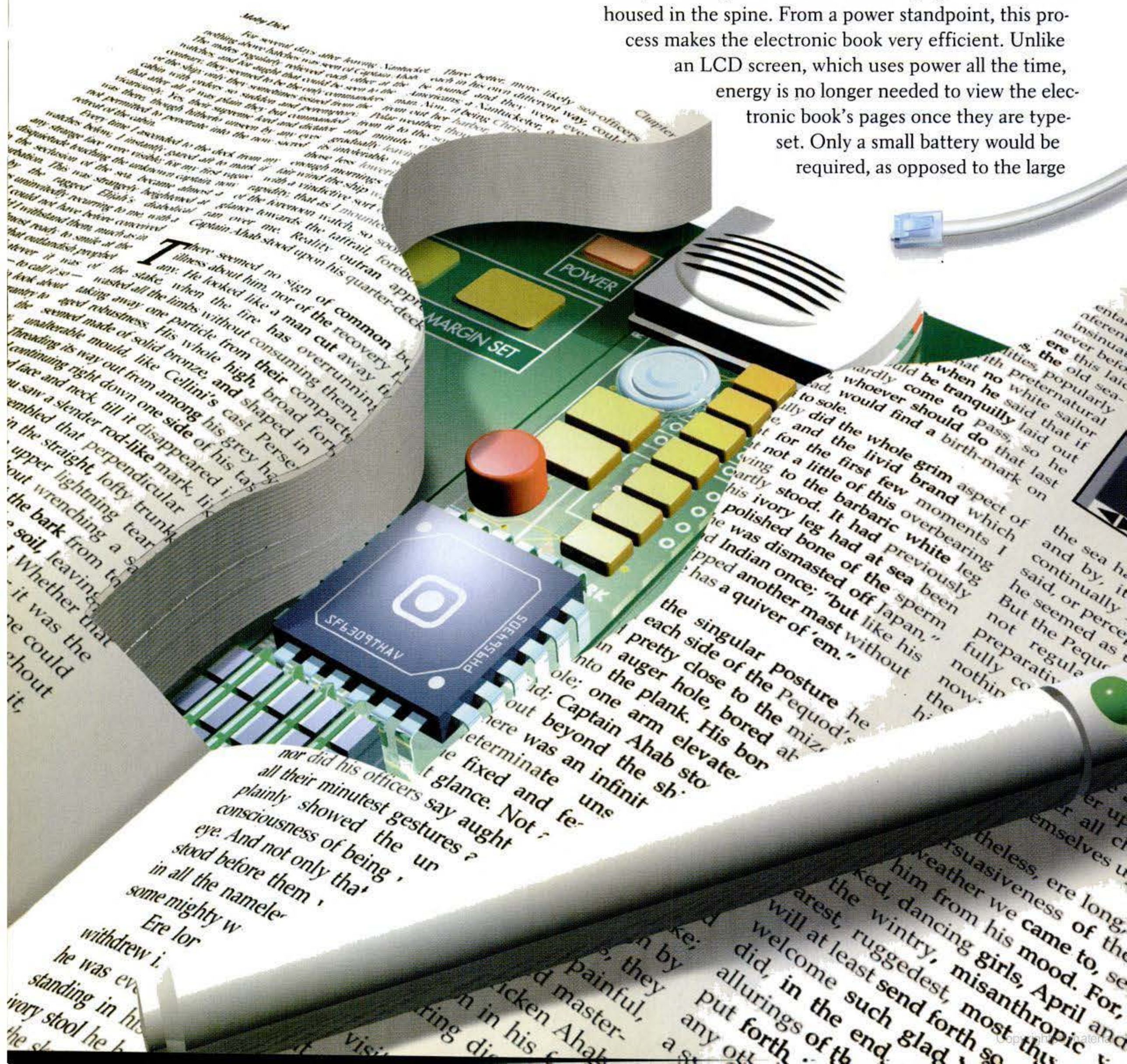
So let's make the *ink* electronic.

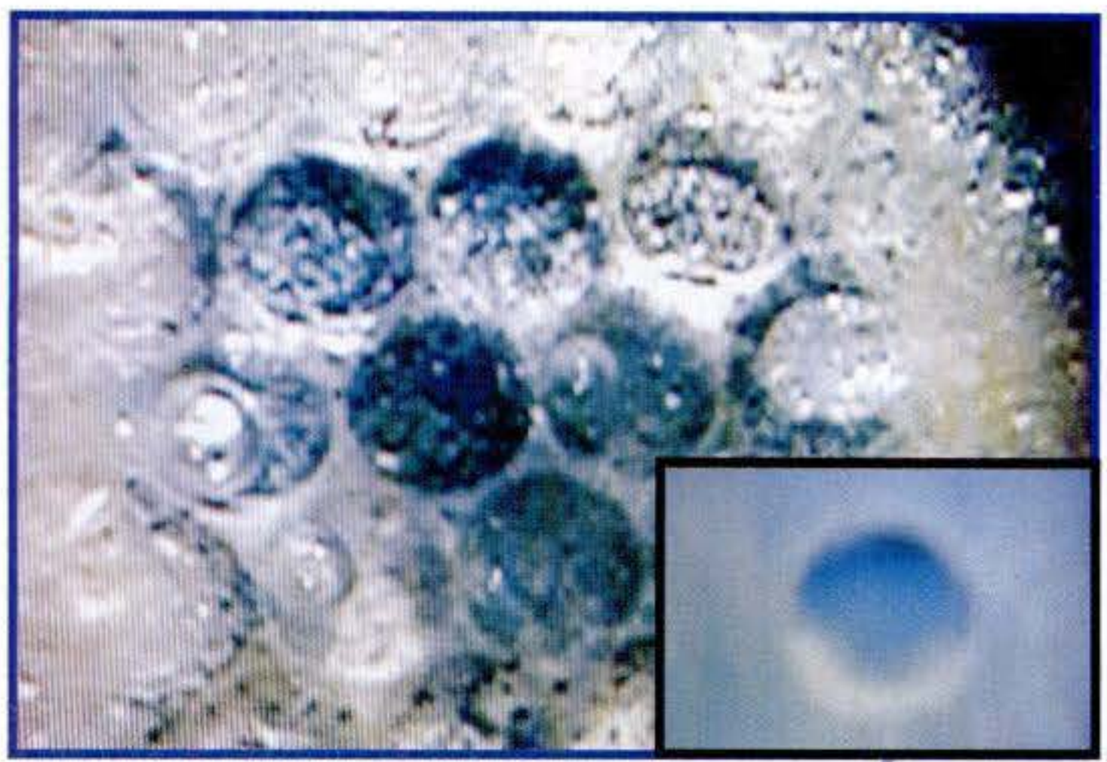
That's the deceptively simple premise behind a project currently coming to fruition at the Massachusetts Institute of Technology. Some hurdles—mostly having to do with large-scale manufacturing—remain, so it will be a few years before you see an electronic book for sale in stores. But the basic technology already exists, developed at the Institute's Media Lab by a team led by physicist Joe Jacobson.

Simply put, each paper page in an electronic book is coated with millions of microscopic particles encased in tiny capsules. Each of these microcapsules can respond independently to an electrical charge: Particles within the capsule moving to the rear appear dark while those moving toward the front look white. The direction in which the particles move depends upon whether a negative (dark) or positive (white) charge is applied. Each microcapsule is about 40 microns in size (that's a little less than half the thickness of a human hair).

The number of microcapsules used on a given page is enormous. For instance, about 1,000 microcapsules might be used to create the letter "A" on this page."The smaller the size of the letter, the more microcapsules you use," says Jacobson, "thereby improving resolution." The target is to have a "paper display" with a resolution higher than that offered by today's computer screens. More than static letters is at stake: Theoretically, the microcapsules could be programmed to "flip" rapidly between dark and white states, providing, for example, a sense of motion in a diagram showing how a car works.

Thanks to electronic ink, the book essentially typesets itself, receiving instructions for each page via electronics housed in the spine. From a power standpoint, this process makes the electronic book very efficient. Unlike an LCD screen, which uses power all the time, energy is no longer needed to view the electronic book's pages once they are typeset. Only a small battery would be required, as opposed to the large





WEBB CHAPPEL

Particles inside microscopic capsules embedded in the paper turn white or dark to form a letter on the page. Each microcapsule (inset) is less than half the thickness of a human hair.

ones needed to power laptop computers and their LCDs.

Convenience, though, is still the main attraction—and that means more than simple portability. Because the information is in electronic form, it can be easily manipulated. You could, for instance, make the type larger for easier reading. Or you could make notes in the margin with a stylus, your observations being stored on tiny, removable flash-memory cards in the spine.

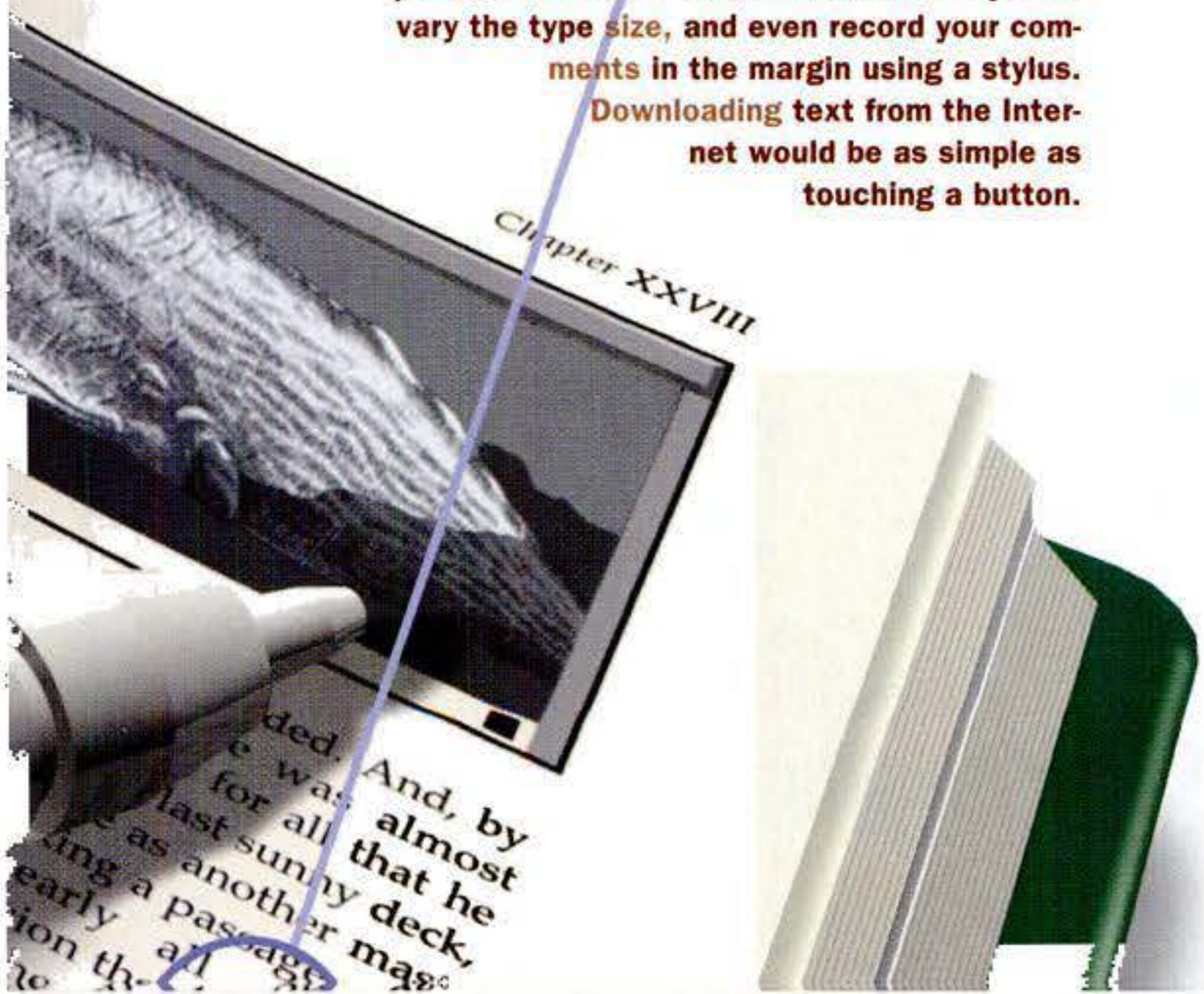
It's likely that electronic books will come pre-loaded with a selection of titles. New titles could be made available through flash-memory cards, for example. Jacobson, though, thinks the Internet will be the delivery method of choice. Imagine browsing through an online bookstore like *www.amazon.com* and downloading a novel into your electronic book via the modem in its spine. Transmitting *Moby Dick* would take about a minute. You could download a few titles, so you'll have a few good reads to choose from while you're relaxing at the beach. If your first choice is not to your liking, a new title becomes available at the push of a button.

Jacobson thinks an electronic book will be affordable—around $200 for a basic read-only model to about $400 for one that would record your margin scribbles. Some hurdles remain, though, before you can take an electronic book with you anywhere. Paper is produced in long sheets, and Jacobson is still working on the best method to integrate electronic ink into that process. To avoid having to use thousands of tiny wires on each page,

Making the Index Electronic

WHAT IF YOU COULD search your hardbound dictionary with your computer? Or keep your paper phone book up to date with wireless broadcasts from a paging service? Or get more information about a topic in a magazine from Web pages stored within it?

The realization of such what-ifs is the vision of Mike Weiner, a software executive turned inventor who was recently granted a patent for an "enhanced book" that can be read and carried around like a regular book, but can be searched and updated electronically. Weiner's patent calls for adding memory chips to printed books or magazines that could hold the full text and pictures of the works, plus additional material. In digital form, the works could be searched and updated via an electronic connection—using a cable or infrared receiver, for example—with a portable or desktop PC. Portions of the book could then be downloaded for use, presumably after you pay for some type of access code. Remote updates via low-power receivers, such as pagers, are also possible. "I think this invention will do for the book what the electric guitar did for the guitar—reenergize it, and give it new life," says Weiner, who has formed a company called In-dex for that purpose in Webster, New York.—*Chris O'Malley*



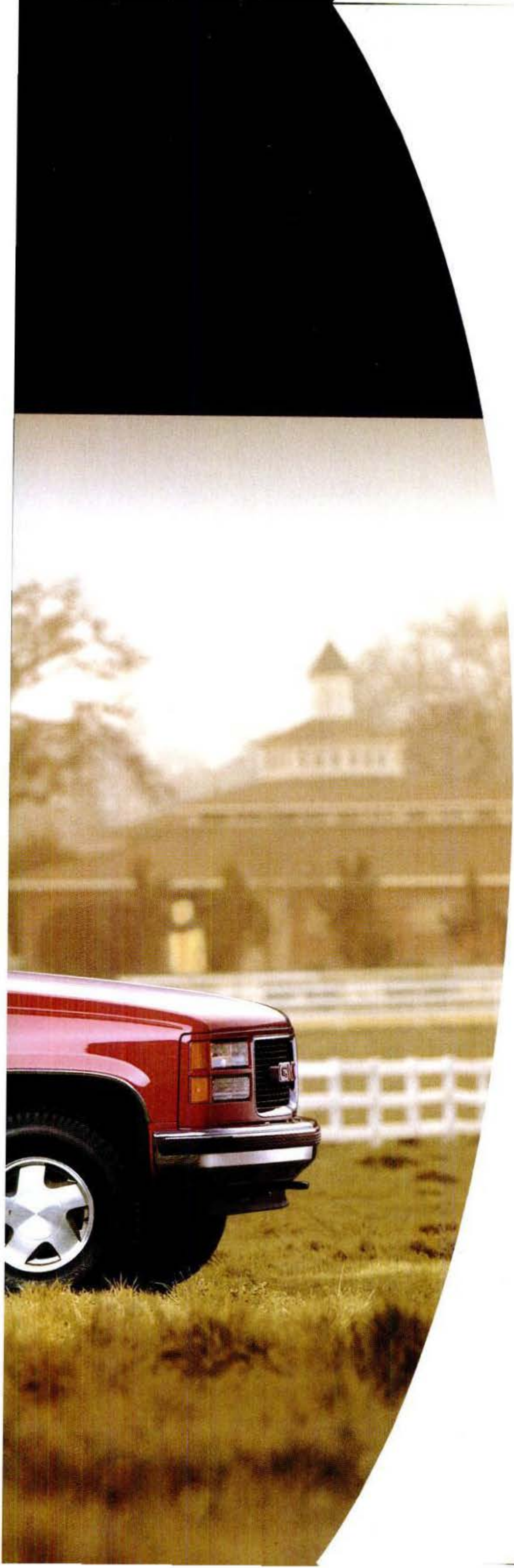
The electronic book being developed at MIT would have an electronic spine housing a modem, battery, microprocessor, and other components. Function buttons would allow you to vary the type size, and even record your comments in the margin using a stylus. Downloading text from the Internet would be as simple as touching a button.

Copyrighted material

LIFE IS FULL OF HURDLES.

GETTING IN AND OUT OF YOUR PICKUP

SHOULDN'T BE ONE OF THEM.



Open its available 3rd Door, the first on any pickup,[1] and you'll quickly realize life will be a little easier with a Sierra by GMC. Waiting to help is an advanced shift-on-the-fly four-wheel-drive system[2] and a choice of powerful Vortec™ engines. A refined interior offers lasting comfort. And standard dual air bags[3] (with passenger-side deactivation switch) help provide peace of mind. So don't just get over life's hurdles; eliminate them for good with a Sierra by GMC.

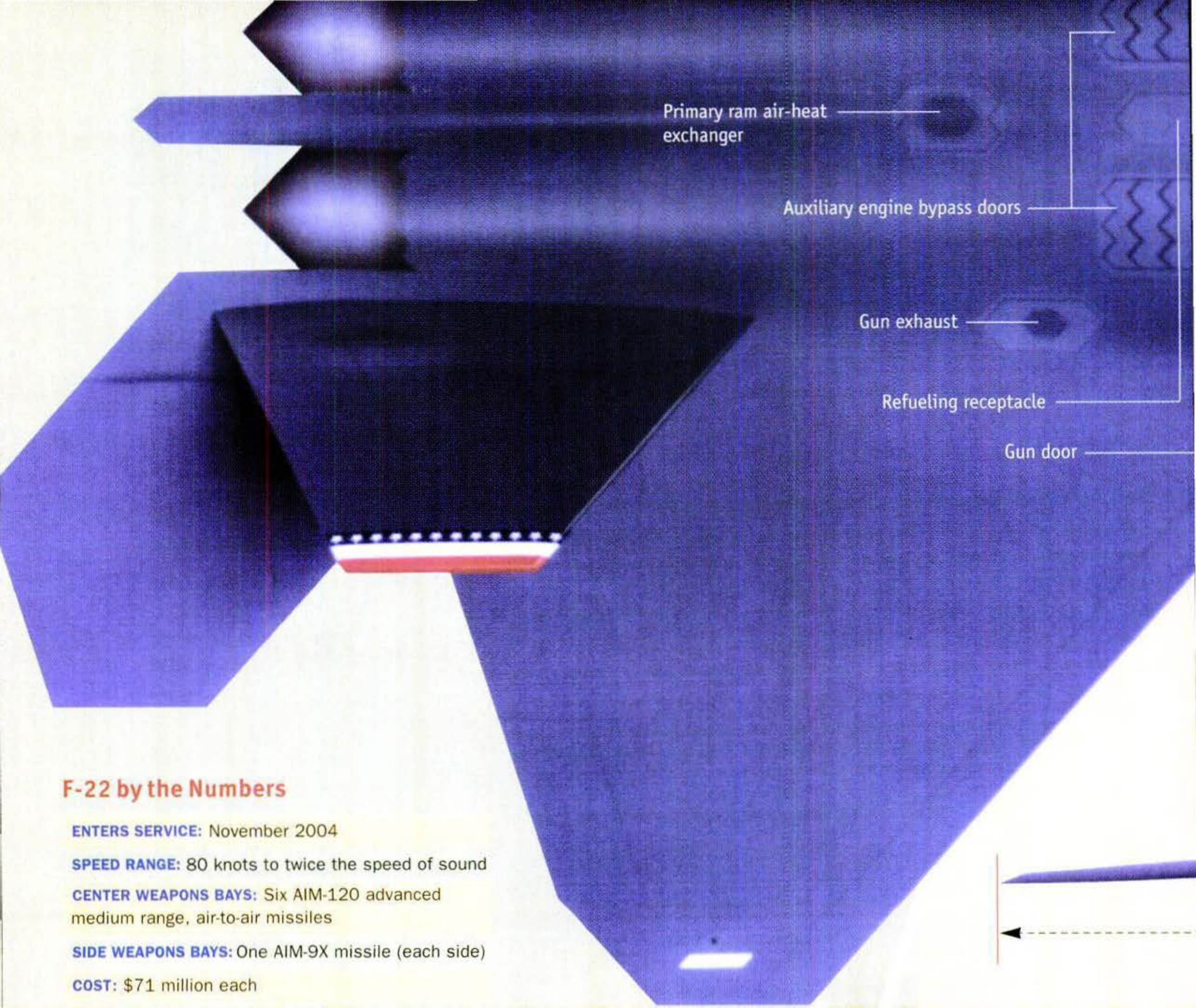
1~800~GMC~8782

www.sierra.gmc.com

SIERRA

GMC COMFORTABLY IN COMMAND™

Copyrighted material



F-22 by the Numbers

ENTERS SERVICE: November 2004

SPEED RANGE: 80 knots to twice the speed of sound

CENTER WEAPONS BAYS: Six AIM-120 advanced medium range, air-to-air missiles

SIDE WEAPONS BAYS: One AIM-9X missile (each side)

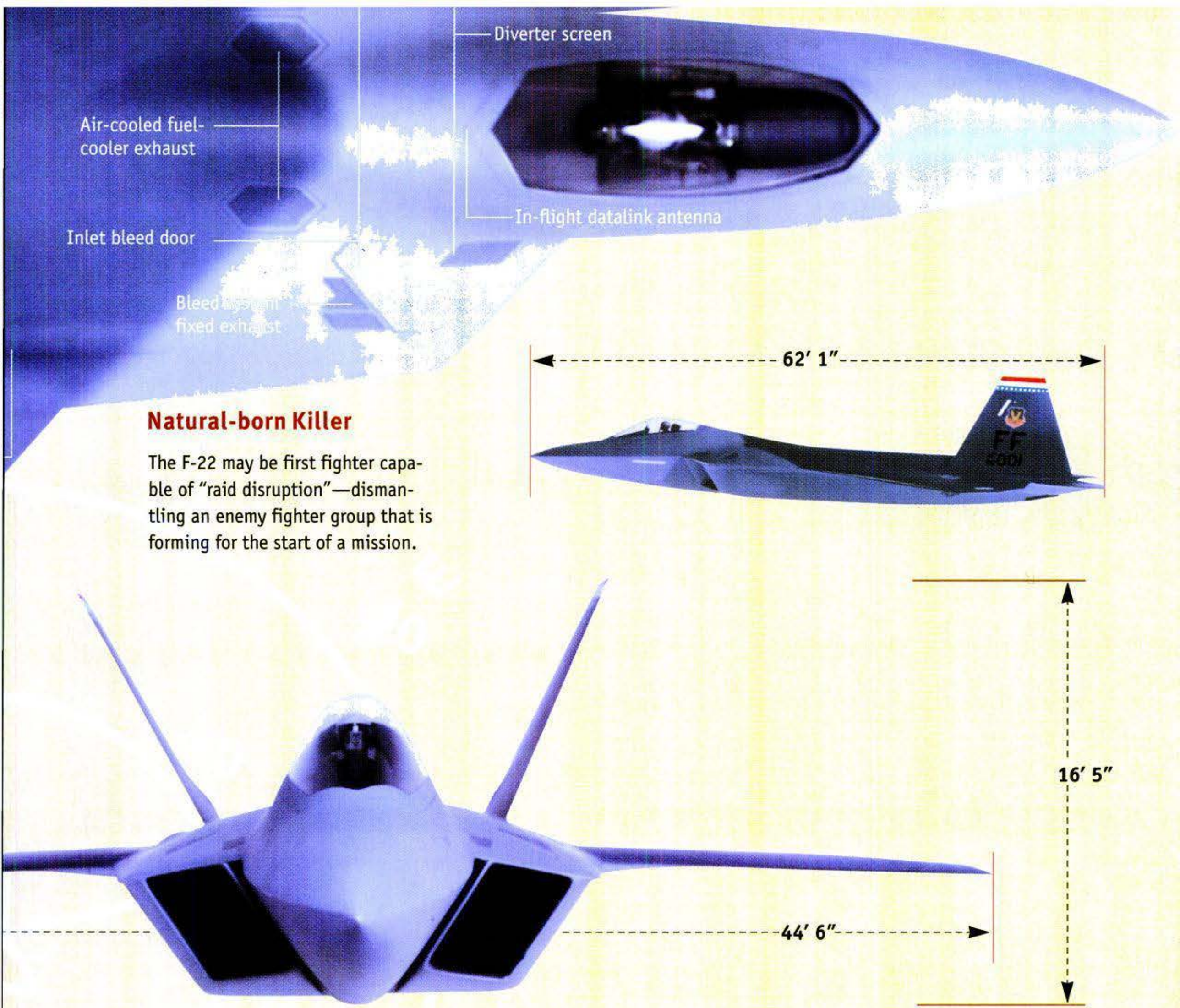
COST: $71 million each

NUMBER: 438 production aircraft

By Bill Sweetman

Top Gun

Copyrighted material



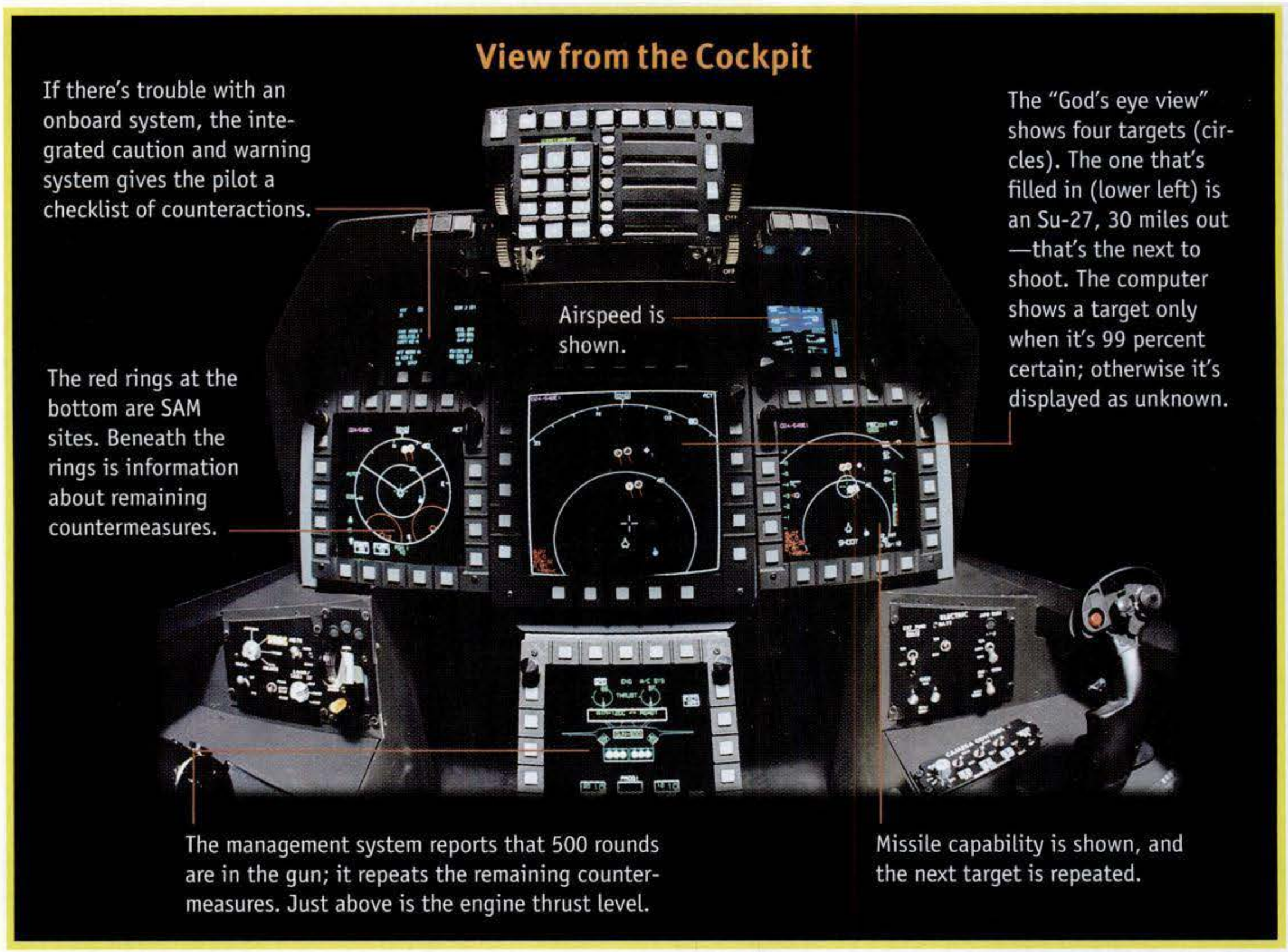
Natural-born Killer

The F-22 may be first fighter capable of "raid disruption"—dismantling an enemy fighter group that is forming for the start of a mission.

The F-22 combines stealth and agility with deadly speed.

LOCKHEED MARTIN'S F-22 represents the greatest advance in fighter capability in 50 years. Its highlight list starts with the biggest increase in sustained speed since the advent of the jet—the F-22 can fly most of its mission at supersonic speeds, which other fighters attain only in short sprints with the aid of fuel-thirsty afterburners. And particularly when moving at those high speeds, the F-22 will equal and probably surpass the agility of any other fighter. The aircraft is also stealthy from all directions, against both radar and infrared systems. Last, its onboard sensors and computers and cockpit displays are a generation ahead of anything else in the world.

Copyrighted material



ERIC SCHULZINGE

In combat, the F-22 pilots will see only what they need to know; if there's enough time, they can scroll through menus for more information.

The new fighter is about the same size as the F-15 Eagle, which it will replace, and at first sight it resembles a smoothed-out, shorter-legged, slightly plumper cousin. But under the skin, the F-15 and F-22 are almost totally different. With a few exceptions—such as the gun and the ejection seat—every part of the new fighter, all the way down to the pilot's helmet, is designed and built with new technology to meet new requirements.

Late in May, Lockheed Martin test pilot Paul Metz is due to assume the controls of the F-22 on its first flight from Marietta, Georgia. It has taken a while to reach this point: By the time the F-22 enters service in late 2004, almost 20 years will have passed since the Air Force first asked industry for a design. That's because the Air Force requirements of stealth, supercruising (supersonic) speeds, and agility seemed, at the time, to be mutually incompatible. Stealth ruled out underbody weapons and fuel tanks, so the new fighter would need more internal volume—but a low-drag supersonic shape demands a slender body and a small, thin-section wing. Maneuverability dictates a large wing and effective controls. This is hard to reconcile, either with the need for a small, thin wing for supercruise—or with the fact that the best tail for a stealth aircraft is no tail at all.

Seven companies originally submitted designs to the Air Force in 1986. Lockheed and Northrop then won contracts to build competing prototypes. In July 1987, Lockheed decided that its initial design was overweight, junked it, and in three months designed the aircraft we see today. The prototypes—two Lockheed YF-22s and two Northrop YF-23s—first flew in 1990. Lockheed's design was judged to be superior and a long, meticulous engineering and manufacturing development program began.

The F-22 has a triangular (delta) wing, blended into the broad, flat body. That keeps drag to a minimum and provides immense internal space—enough for 11 tons of fuel, or twice as much as an F-15 carries. The blended shape makes room for cavernous weapon bays for six radar-guided AMRAAMs (Advanced Medium Range Air-to-Air Missiles) and two heat-seeking AIM-9X Advanced Sidewinders. Alternatively, the bays under the fuselage can each hold a 1,000-pound precision-guided bomb in place of two of the AMRAAMs. Aft-mounted horizontal tails, rather than nose-mounted canards, provide pitch control. Designing a stealthy canard is difficult, particularly if the canards are big enough to enable the airplane to recover quickly from an extreme nose-up attitude. The twin vertical tails are mounted well forward to maintain control at high angles of attack (nose up). Thrust-vectoring en-

Copyrighted material

gine nozzles deflect the engines' full thrust 20 degrees up or down inside of a second.

The F-22 will be more agile than today's fighters. For example, the F-16 and F-15 can go out of control if the pilot tries to roll the aircraft when it is flying slowly at a nose-high angle. So the onboard computers impose increasingly tighter limits on the rate of roll as the speed drops, and eventually prevent those aircraft from rolling at all. But in tests of the YF-22, Lockheed pilots pulled the nose up to 60 degrees and could still perform a 360-degree roll—a very quick way of pointing the nose and missiles at an enemy in combat. There is a lively debate over the utility of such low-speed antics [see "A Muscular Challenger to the F-22"], but the F-22, with its immense thrust and acceleration, will at least be able to recover quickly from such a maneuver.

Part of the F-22's secret is undiluted brute force. Each of the plane's Pratt & Whitney F119 engines pumps out 39,000 pounds of thrust. But that's not all: The F119 can run full-blast at speeds at which other engines must be throttled back to avoid overheating. Above Mach 1, the F119 develops twice as much thrust as the F100 engine in the F-15.

In fact, the F-22 can move so fast that the pilot's side-stick has a soft stop when it is pulled aft. The pilot has to pull the stick through the stop to obtain full control power. Lockheed Martin engineers and pilots have dubbed full power "Mongo mode," in tribute to the horse-punching heavy from the Mel Brooks movie *Blazing Saddles*.

With such power and speed available to pilots, control mistakes could be costly. So the F-22's computer system provides a safety cushion for the pilot's "carefree abandon." Whatever the pilot does, the flight-control computers will not let the airplane's structure become overloaded or permit the craft to go out of control.

The F-22's stealth technology is evolved from the F-117's. For stealth, the F-22 shares the F-117's flattened sides and sharp "chine" line around the middle of the forward fuselage. But most of the F-117's sharp-edged facets have been blended into curves.

Unlike the F-117, the F-22 is not "candy coated"—that is, covered with radar-absorbent material. Instead, designers applied the material to radar hot spots such as the chine line, the edges of the wing and tail, and the snaking ducts that feed air to the engines. Also, more than 30 antennas for communications, navigation, and electronic warfare are carefully buried in the fighter's skin. A side-hinged door covers the muzzle for the M61A2 Gatling gun.

Designers originally expected that the F-22 would be largely built from carbon-fiber composite materials. But composites make up only 25 percent of the structures, mostly in the wings and tails. The materials turned out to be expensive, largely because they had to be engineered to withstand high temperatures or tolerate battle damage. Instead, more than 40 percent of the airframe is titanium, which is strong but less expensive. The largest parts in the F-22 are five huge titanium bulkheads in the mid-body, which carry the wing loads—the biggest of them, measuring 12 feet across and six feet from top to bottom, is made from a three-ton titanium forging.

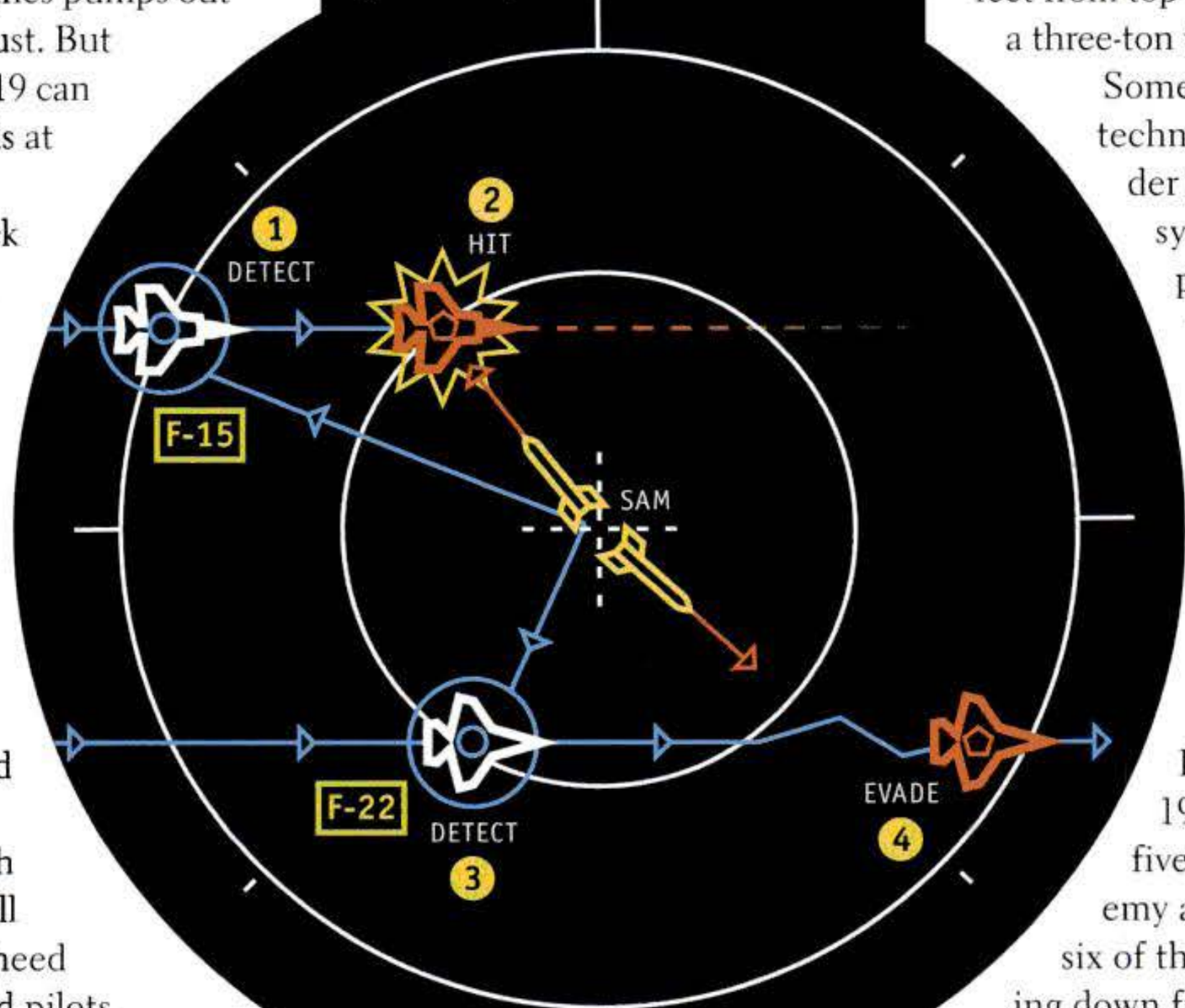
Some of the most radical technology in the F-22 is under the skin—a complex system of sensors, computers, and displays that will help the pilot perform better in battle. This system addresses an ongoing problem. Comments Paul Metz: "If you look at history, very few fighter pilots have been effective." Between the World War II years of 1939 and 1945, only one pilot in five shot down a single enemy aircraft—and only one in six of those became aces (shooting down five or more). The results have not much improved since then. "What if we can increase the ratio of pilots who make kills from one in five to one in two, or even one in three [with the F-22]?" suggests Metz.

But there has been concern that more complex fighters can simply overwhelm the pilot with raw data,

How to Outpace a Missile

1 Conventional fighter detected. The surface-to-air missile (SAM) system projects the target track and launches to an interception point.

2 Because the interception point is close, the missile retains enough energy to counter its aircraft target's escape maneuvers.



3 The stealthy F-22 is not detected until it is much closer. Because the range is greater—and the F-22 flies faster than other fighters—the missile intercepts later. By that time, the missile must perform a low-energy long tail chase against the aircraft target at the limits of its tracking range.

4 With a moderate supersonic jink, the F-22 loses the missile.

SLIM FILMS

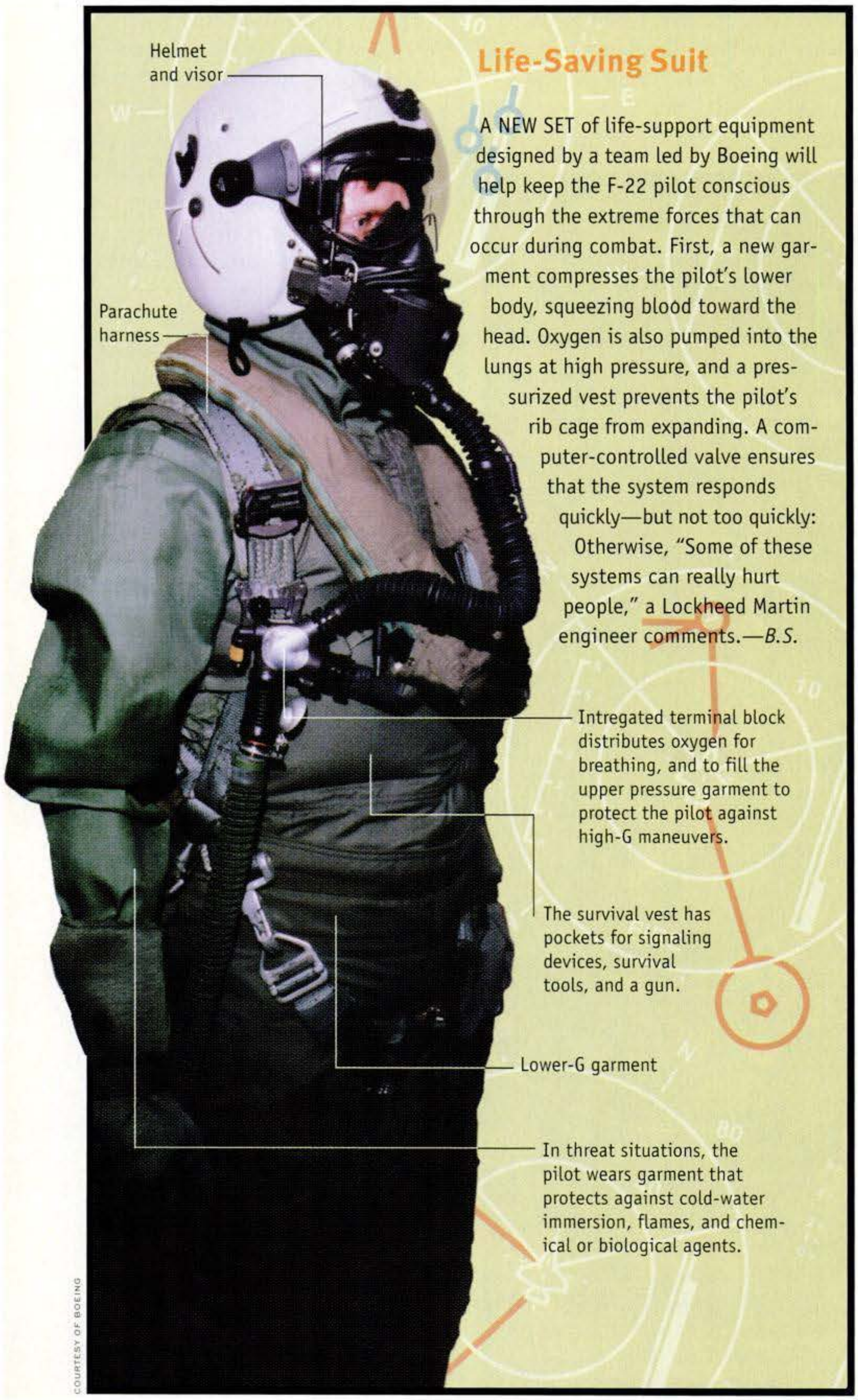
Copyrighted material

making these planes too complicated to fly effectively in a conflict—and that the F-22's capabilities could make made this problem worse. Greater speed makes attackers as well as targets approach more quickly, and stealth poses new questions for pilots: Should I use my radar and attack, or close quietly to short range? Should I aim directly for a SAM (surface-to-air missile) radar, presenting my smallest possible radar image, or turn away from it and risk detection?

The F-22's solution is a totally new avionics system based on a supercomputer-like central processor. The processor accomplishes what its engineers call "sensor fusion." Computer software takes the inputs from the radar antenna, the sensitive arrays that detect hostile radars, and datalinked information from other aircraft (such as AWACS). The best data from all sensors are combined with information from the computer database to create a single target for the pilot, rather than a confusing blip on a monitor. [See "View from the Cockpit."] The computers also constantly recalculate the range of the F-22's missiles and its adversary's weapons. Another display shows the range of any SAM radar in the area. If the pilot turns, exposing the side of the F-22 to detection, the range circle will expand to warn him. The objective is to improve the pilot's "situational awareness"—a response to the fact that 90 percent of pilots who have been shot down and survived never saw what hit them.

Another goal is to use the radar only when absolutely necessary to set up an attack or identify an aircraft that is getting close enough to become a threat. The F-22 computers track the position and speed of the target, determine what is known about it, and calculate when and how to best use the radar. The radar array itself is unique, comprising almost 2,000 finger-size modules, each of them a tiny radar transmitter and receiver, built into a fixed base. The radar beam can jump from target to target much more quickly than can a moving radar dish. The array should also be more reliable than previous ones, because it eliminates the antenna drive mechanism and the single high-voltage power supply, the parts of a conventional radar that fail most frequently.

Another unusual aspect of the F-22 is the absence of a two-seat version—the "family model" F-22B was canceled last year to save money. The Air Force believes that the F-22's carefree handling and intuitive avionics will make it safe for a single pilot to handle, while its datalinks and mass electronic memory will allow instructors to monitor a student's skills almost as closely as if they were in the back seat. One snag remains:



Life-Saving Suit

A NEW SET of life-support equipment designed by a team led by Boeing will help keep the F-22 pilot conscious through the extreme forces that can occur during combat. First, a new garment compresses the pilot's lower body, squeezing blood toward the head. Oxygen is also pumped into the lungs at high pressure, and a pressurized vest prevents the pilot's rib cage from expanding. A computer-controlled valve ensures that the system responds quickly—but not too quickly: Otherwise, "Some of these systems can really hurt people," a Lockheed Martin engineer comments.—*B.S.*

COURTESY OF BOEING

A Muscular Challenger to the F-22

SEPTEMBER 1996: In the clear, cool late-summer skies over Surrey, England, the Sukhoi Su-37 fighter steals the Farnborough air show. Standing on its tail, slowing almost to a standstill, the fighter demonstrates that it can flip right, left, or backward to fire a missile.

If Lockheed Martin's F-22 is the James Bond of fighters—inscrutable, sophisticated, and keeping the 9mm Beretta out of sight—the Su-37 is Rambo: It's half as big again as anything else, menacing in looks, and bristling with weaponry.

The F-22 soon takes its first flight, but the Sukhoi Su-37 is ready now.

Unlike the F-22, the Su-37's technology is already flying at air shows and on the export market. Its key features, including vectored thrust and canard foreplanes, will be used on the closely related Su-30MKI fighter that Sukhoi is building for India. Moreover, Russia's newest R-77 air-to-air missile out-ranges the Advanced Medium Range Air-to-Air Missiles (AMRAAMs) that will be carried on the F-22. These make some observers wonder if the F-22 will be good enough for the 2000s.

There is, however, a fundamental debate about the tactical value of the level of "supermaneuverability" the Su-37 possesses. Yanking the nose around enables a fast shot at an adversary—but it also renders the aircraft a big, fat, slow target for anyone else in the sky: "It's a neat trick, but it's [deleted] to use in air combat," says one U.S. fighter commander.

Neither does the Su-37 embody one iota of stealth technology. From its vast vertical tails to its cavernous, dead-straight inlets, it's as inconspicuous to radar as a polar bear in a coal shed.

So which is the better option: stealth or agility? The answer may come during trials of the F-22, which test pilot Paul Metz says, "will be evaluated against real and simulated adversary aircraft."—*B.S.*

QUADRANT PICTURE LIBRARY

There will be no free rides for generals, Congress, or the media.

Advanced as it is, the F-22 has been designed so that it will now need less maintenance than other fighters. To refine design details for maintenance procedures, engineers donned clumsy chemical-warfare suits and worked alongside Air Force mechanics on the flight line. One result is that installing new parts has been simplified. A worker wearing gloves can, for example, replace computer modules without using tools.

Built-in equipment also replaces plane-loads of specialized test gear. Before the F119 engine was even designed, the Air Force and Pratt & Whitney chose a small set of simple sockets and wrenches and told designers that no other tools could be used to maintain the outside of the engine. On a 30-day overseas deployment, 24 F-22s should need half as many maintenance workers as would the same number of F-15s. The F-22s will also require just eight, instead of 18, plane-loads of diagnostic and servicing equipment.

Such an imposing roster of capabilities comes, perhaps unsurprisingly, with a hefty price tag: $17 billion for development and $71 million (in 1996 dollars) for each of the 438 aircraft the Air Force plans to buy. Some critics have suggested scrapping the F-22. Budget hawks have argued that the Pentagon cannot afford all three of its new fighters: the F-22, the Navy's F/A-18E/F Super Hornet, and the three-service Joint Strike Fighter. Others add that the F-22 was designed to combat a threat that no longer exists and that a modified F-15—or the Joint Strike Fighter—would suffice.

Today's F-15 has shot down 96 adversaries with zero losses in air combat. However, the Air Force argues, a more lethal and survivable replacement is needed as Russia and China develop and export advanced fighters like Russia's Su-37 and SAMs. While relying on the Joint Strike Fighter looks attractive now, with its apparently low price tag, the project is 10 years behind the F-22—and costs may likely increase over time. Also, the Joint Strike Fighter design trades speed, agility, and acceleration for internal weapons and lower cost.

Two factors support the need for a fighter that outclasses new-aircraft threats, rather than matching them, as an improved F-15 might. First, U.S. and allied forces are likely to be outnumbered in the early stages of a conflict. Second, the U.S. public and political leaders expect quick success and minimal losses—and the F-22's Bambi-meets-Godzilla ascendancy over any current or planned fighter can provide that.

As Brig. Gen. James Fain, then the Air Force's program manger, put it a few years ago: "The idea is to be back in the bar drinking a beer before the other guy knows what hit him." ◆

Copyrighted material

Ford Credit

*Based on an average of consumer-reported problems at 3-months' ownership in a survey of Ford and competitive models designed and built in North America. Sales leadership based on Divisional sales.

www.ford.com

ONLY THE NEW FORD F-150
BROUGHT HOME THE PRESTIGIOUS
1997 MOTOR TREND
TRUCK OF THE YEAR AWARD.

ONLY STANDARD
SUPERCAB THIRD DOOR.

Copyrighted material

IT'S THE ONLY TRUCK WITH SO MANY ONLYS.

BUILT FORD TOUGH

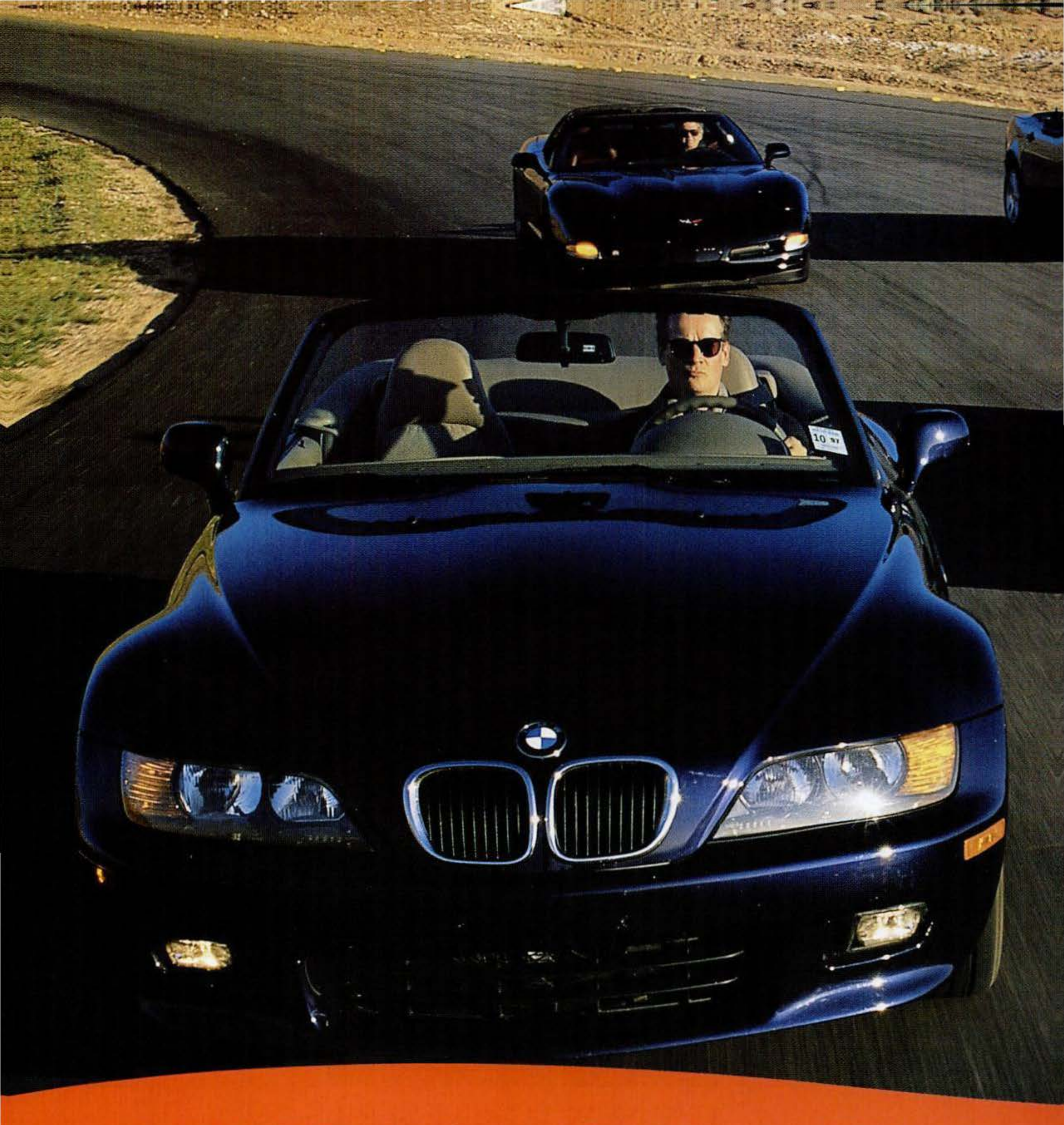
THE NEW FORD F-SERIES.

THE BEST-BUILT, BEST-SELLING AMERICAN TRUCKS.*

ONLY TRUCK IN ITS CLASS WITH AVAILABLE OVERHEAD CAM V-8 ENGINES – INCLUDING THE NEW 5.4L TRITON™ V-8.

ONLY 60/40 SPLIT REAR BENCH SEAT.

Copyrighted material



ONE GLANCE AT A SHAPELY fender or the zing of a tach needle is all it takes to scramble many a hard-earned nest egg. Staying focused on the kitchen remodeling job is made easier by the fact that a gotta-have sports car usually arrives only once in a decade. Imagine the consternation when not one but four marvelous sports cars in the $40,000 range arrive in the same model year. Three revered German marques—BMW, Mercedes-Benz, and Porsche—and Chevrolet have seized this moment to redefine what a modern sports car should be.

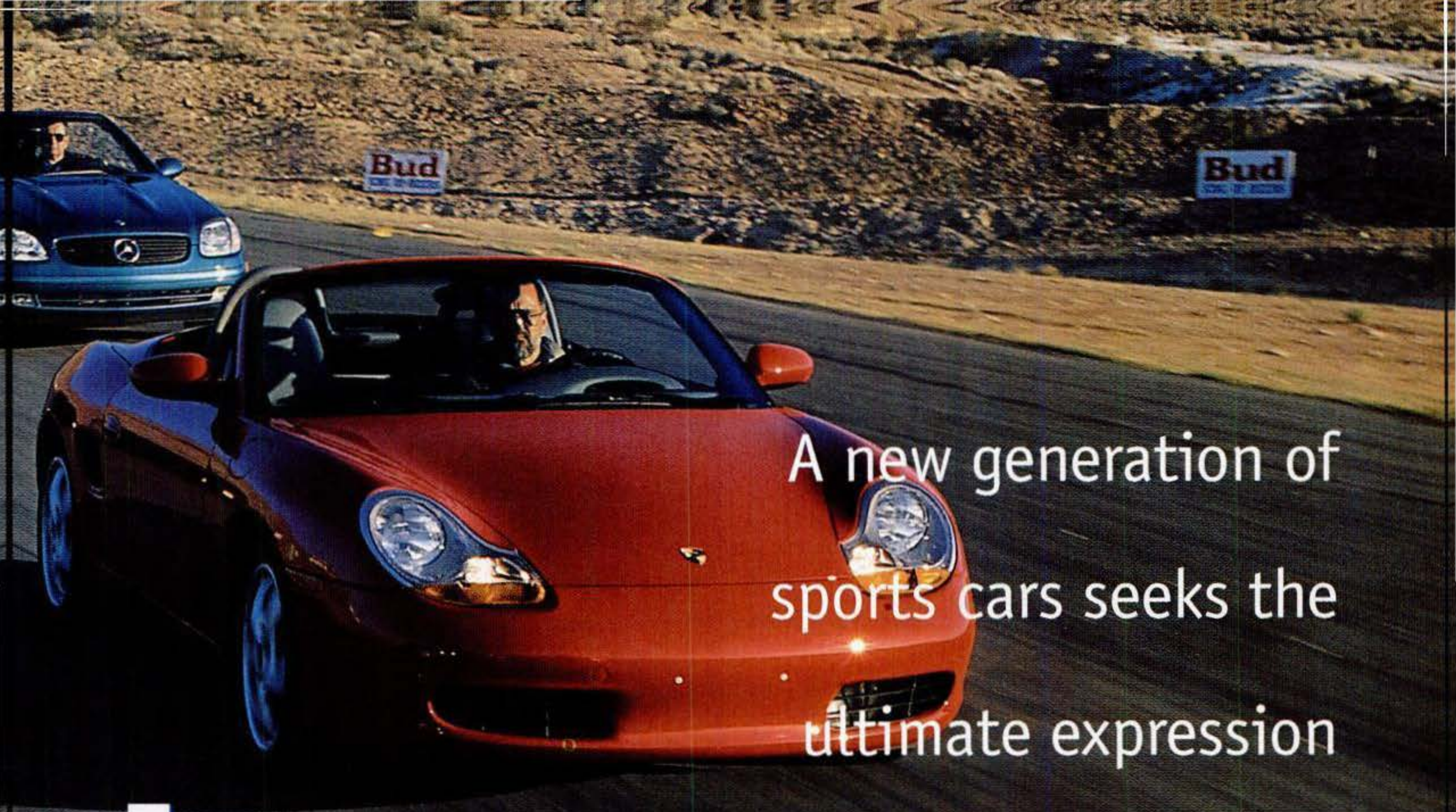
By Don Sherman

BMW's Z3, Mercedes' new SLK230, the Porsche Boxster, and the fifth-generation Corvette (C5) have more in common than seats for two, infinite headroom, and a 40-grand price tag. Each strives for the finest combination of heritage, performance, technology, and sex appeal that can be squeezed between a pair of fenders. To find out which best fulfills that lofty aspiration, we spent a full week of test-track, race-track, and mountain-road evaluations in the Golden State.

Laden with character, each marque leans heavily on its heritage to create a distinct personality.

With the help of James Bond in *Goldeneye*, the

PHOTOGRAPHED BY JOHN B. CARNETT



A new generation of sports cars seeks the ultimate expression of speed and driving pleasure.

Jazzy Quartet

CHEVROLET CORVETTE
MERCEDES-BENZ SLK230
BMW Z3 2.8
PORSCHE BOXSTER

BMW Z3 was launched with a four-cylinder engine as a prelude to what the Bavarian Motor Works really had in mind: a 2.8-liter inline six for go power with attendant suspension and brake upgrades. Manufactured in South Carolina, the Z3 can trace its lineage to BMW's first car, a 1928 15-horsepower Dixi roadster.

Mercedes' charming SLK is essentially a half-price alternative to its V8-powered SL roadster. A supercharged four-cylinder engine develops 185 horsepower and ample torque; but the real treat is watching the roof fold into the trunk at the touch of a button.

The new Porsche Boxster traces its roots back 50 years, when Professor Ferdinand Porsche designed the first car to wear his name. The concept was a mid-engined sports roadster similar to the new Boxster. Considering the recent two-decade gap between all-new Porsches, it's not surprising the professor's car has been so long in coming.

While these three European marques were finding an American audience, Chevrolet staked out the big-displacement territory still dominated by the Corvette—mainly managing to keep it in the same price range as the smaller euro-roadsters, accompanied by considerably higher performance. Developing the new Corvette,

BMW Z3 2.8

The BMW's manual top and straightforward cockpit layout maintain the best traditions of the British roadster, albeit with a significant increase in performance and handling finesse.

engineers heeded four decades of heritage—keeping pushrod V8 power and their favorite design cues while modernizing Chevy's flagship with advanced technology.

Packing the biggest engine, the most power, and the fattest tires, the Corvette wastes no time showing the rest of this field four tail lamps large enough to signal ships at sea. Actually, everything about the Corvette is big, including the cargo hold, now larger than a Lincoln Town Car's trunk. Speed and handling are traditional Corvette virtues; what's been added is refinement. The stiff chassis provides a solid foundation for supple suspension gear. Punishment is no longer the price for performance.

The steering is more sensitive than before and behavior at the limit of adhesion is predictable and progressive. In cruise mode, the Corvette's ride is relaxed.

On the racetrack, our driver praised the Corvette's strong braking power, its broad-band torque, and stable cornering on the way to the fastest lap times in this group—an average 93.1 mph around the Willow Springs Raceway's boot-shaped circuit.

Regardless, the C5's acceleration, handling, and braking figures show little or no improvement over the measurements we registered five years ago in an 300-horsepower LT1-engined C4. The new aluminum-block V8 engine is sufficiently rough at idle to rattle gears in the transmission, buzz the shift lever, and shake the steering column. Stowing the lift-off roof consumes about half of the huge cargo hold and leaves that panel vulnerable to scratches from shifting luggage. Some interior pieces—such as the sun visors' plastic pivots—don't feel substantial enough for the long haul. We tested a pilot model, so we've got our fingers crossed that Chevy makes amends—particularly in engine balance—for regular production.

The Mercedes SLK lies at the opposite end of the performance spectrum from the Corvette. That may be the inevitable result of a low cylinder count and the absence of a clutch pedal, but a case could be made that this car doesn't fit the classic definition of a sports car. It's more of a touring roadster. While the SLK boasts a long list of endearing traits, none of them make the car fun to drive. The engine delivers a heartening mid-range punch handy for passing traffic or charging up Willow Spring's turn four, but it runs out of revs at a humdrum 5,800 rpm and sounds like a garden tractor en route. There is a distinct lack of feedback through the steering wheel and excess travel before the brake pedal delivers stopping power.

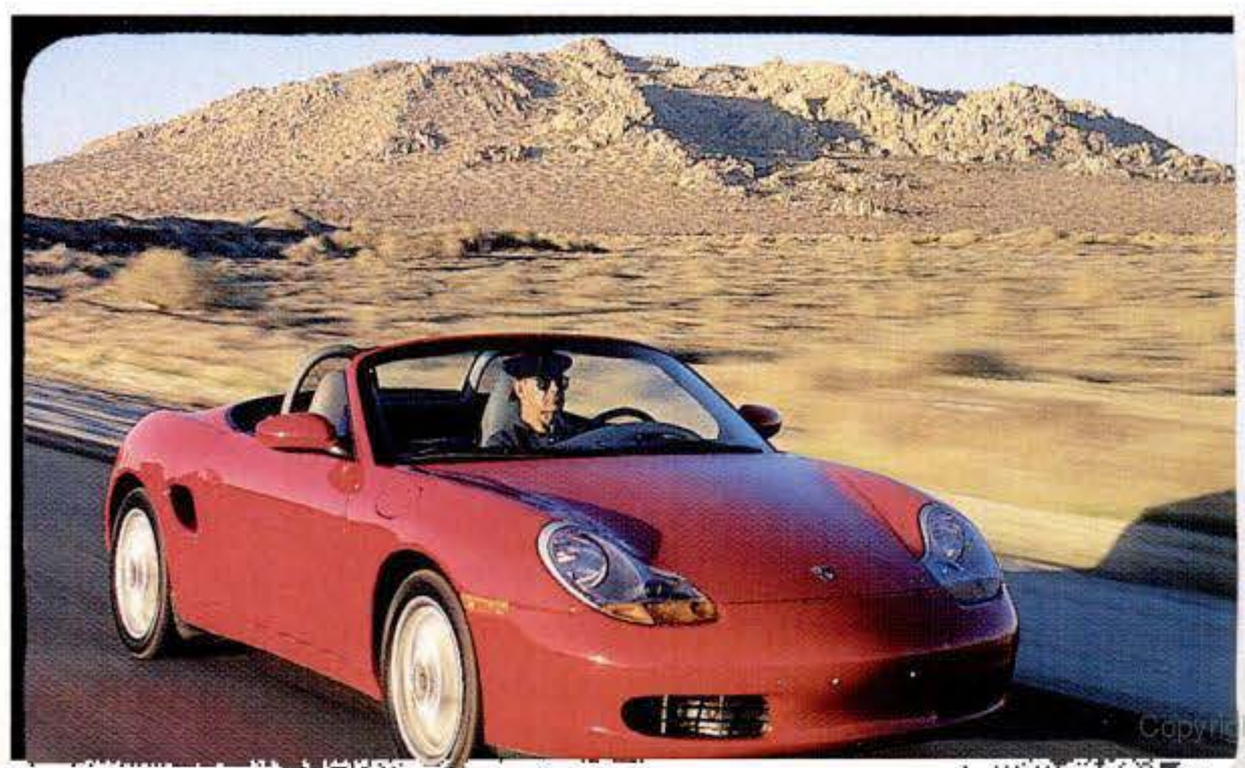
Endearing traits include fuel economy, shake-free structure, high levels of cornering adhesion, reassuring understeer at the limit, and a dashing interior decor. A large red console button triggers a spectacular 25-second roof retraction, the best disappearing act since Houdini.

In contrast to the SLK's aloof attitude on winding mountain roads, the BMW Z3 is lively and game to run. This car comes closest to the classic British roadsters with its engaging personality, willowy substructure, simple folding top, and rudimentary rear suspension.

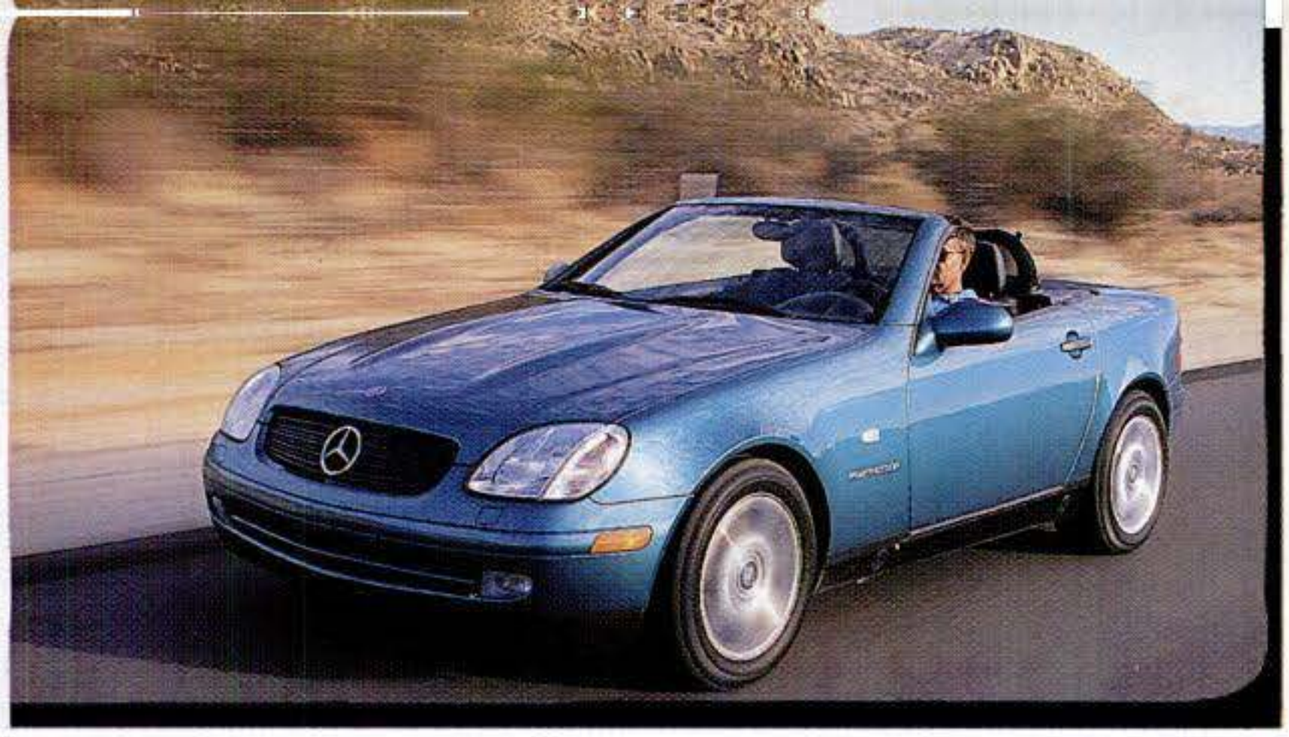
The Z3's 2.8-liter inline six pours out prodigious power with creamy smoothness from idle to its 6,250-rpm redline. Special features include variable valve timing and an aluminum block with cast-iron cylinder liners. Lightweight construction limited the total weight gain over the four-cylinder Z3 to 143 pounds. The net result is an

Porsche Boxster

The Boxster's instrument hood lets a peek at the horizon show through. Elbowroom is reasonable, seating supportive, and the two-trunk storage downright remarkable for a two-seat, mid-engine roadster.



Copyrighted material



Mercedes-Benz SLK230

Simulated carbon fiber decorates a well-designed instrument panel; but the visceral thrill comes when the SLK's retractable top does its thing.

entertaining power-to-weight ratio that delivers 6.1-second 0-to-60 acceleration and sprightly passing punch, sufficient to keep the Z3 on the Corvette's heels.

While the Z3 is an absolute ball on a mountain pass, our driver described it as "very nervous" on the Willow Springs road course. It was darty during hard braking and reluctant to skew toward corner apexes under moderate braking. The tail was prone to breakaway with little warning, but catching it with appropriate steering and throttle corrections posed no problem. The BMW Z3 2.8 placed the highest priority on driving skill.

On a 1-10 pure-lust scale, the Porsche Boxster scores a 12. We're not entirely sure if that's attributable to lipstick-red paint, this car's fetching proportions, its delightful driving nature, or too many 80-degree top-down days in California.

This is a case where performance figures tell only a fraction of the story. The Boxster is merely third quickest in acceleration and it demonstrated the lowest cornering adhesion on our skidpad. The fact that it's the most expensive of this new-breed set is another debit. That said, there's plenty to love in Stuttgart's latest prodigy.

Since the mid-engine layout was first exploited for a production sports car some 35 years ago, it's earned nothing but bad raps. Wiping the slate clean is the Boxster's primary mission, and that it does with consummate grace. The package is light, roomy, and dimensionally tidy. The rear trunk will swallow two sets of golf clubs, leaving space in the front trunk for weekend luggage. The power-assisted soft top folds away in 12 seconds after one latch is released and a button on the dash is tapped. The styling reminds us of past Porsche glories while rendering a fresh aesthetic for the next millennium.

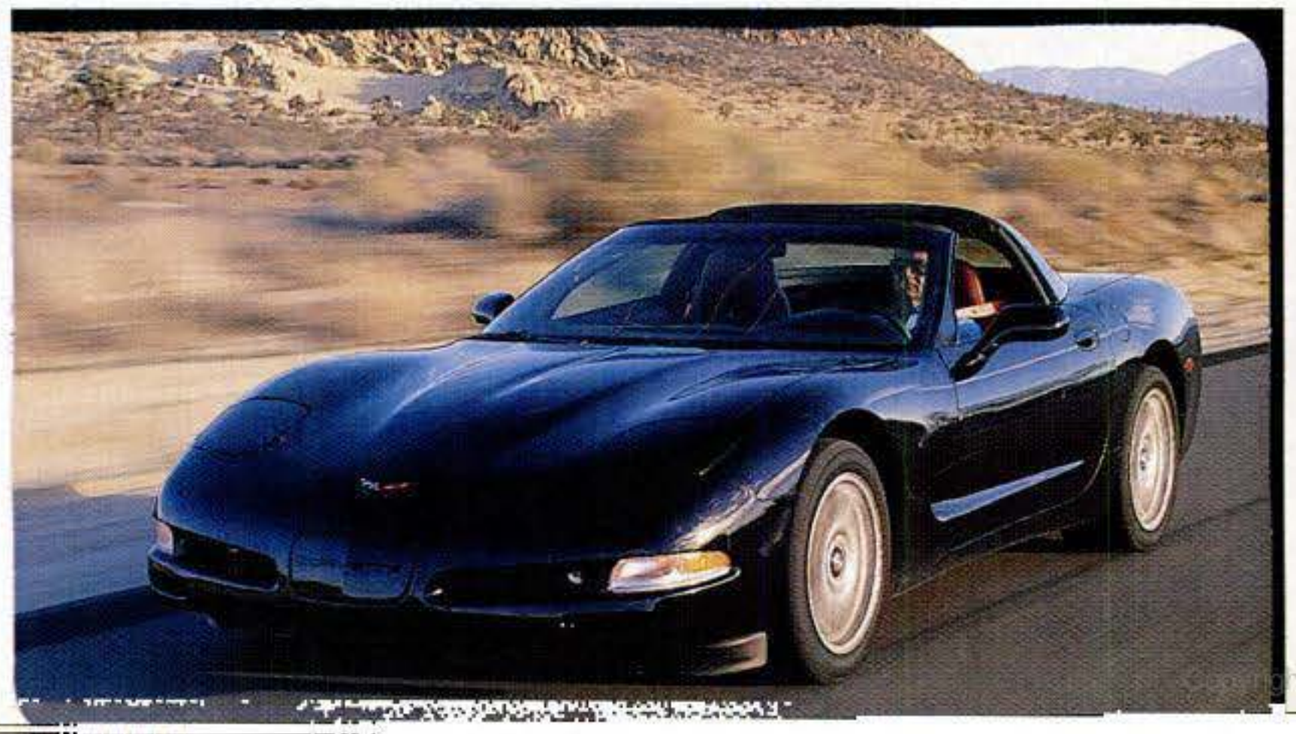
The one Achilles' heel is engine access: There's no joy in beholding the Boxster's four-cam, 24-valve, tuned-induction, all-aluminum boxer six, because it's packed away in a virtually inaccessible compartment behind the seats. Fluids are replenished through front and rear trunk openings and service access is from the bottom.

The mid-engine layout may remain a bone of contention, but there's no denying the fact that the Boxster is a pleasure to drive. The steering is quick and more communicative than any other car in this quartet. Supple suspension settings make every road feel freshly repaved. Yet, during aggressive maneuvers, this machine refuses to wag its tail. The agile Boxster delivered the best slalom and double-lane change speeds. Compensating for the lowest torque peak in this test by exhibiting the best balance, the new Porsche raced around the Willow Springs racetrack at an average speed on par with those of the Benz and the Bimmer. This car's engine song—polite whirring at low speeds, changing to a stirring aria when induction resonance chimes in at 4,200 rpm—will drive grown men and women to sign up for thick monthly-installment books without regret.

The real beauty of this quartet is that there are no bad choices. What the Mercedes lacks in driving pleasure it more than makes up for in panache. The BMW Z3 rewards competent hands on the controls with a fleet, fun ride through life *and* change back from $40,000. The new Corvette is the uncontested speed king and the most comfortable model in this marque's 44-year history. But the one car well worth sacrificing lunch and maybe even dinner for the next five years to own is definitely the Porsche Boxster.

Chevrolet Corvette

The new Corvette is no longer a contortionist's dream. Now you enter with ease, thanks to a lowered doorsill. The cockpit is supportive and the redesigned instruments are legible.



ghted material

To design a wiper blade that cleans we went back and forth. And back

The cleanest wipe.
The longest life.

©1997 Robert Bosch Corporation, Sales Group.

Copyrighted material

better and lasts longer,
and forth. And back and forth.

When designing the Bosch Micro Edge Excel, we weren't satisfied until we got it right. The result is a revolutionary wiper blade that not only cleans better but also lasts longer.

Only Bosch Micro Edge Excel features a patented dual rubber compound process. It begins with a synthetic rubber flex element that delivers superior blade "flip over" flexibility in both hot and cold weather extremes. Then we added an exclusive natural rubber wiping edge. The result is superior wiping performance, reduced streaking and improved wear resistance. And with its solid steel frame, it's built to last.

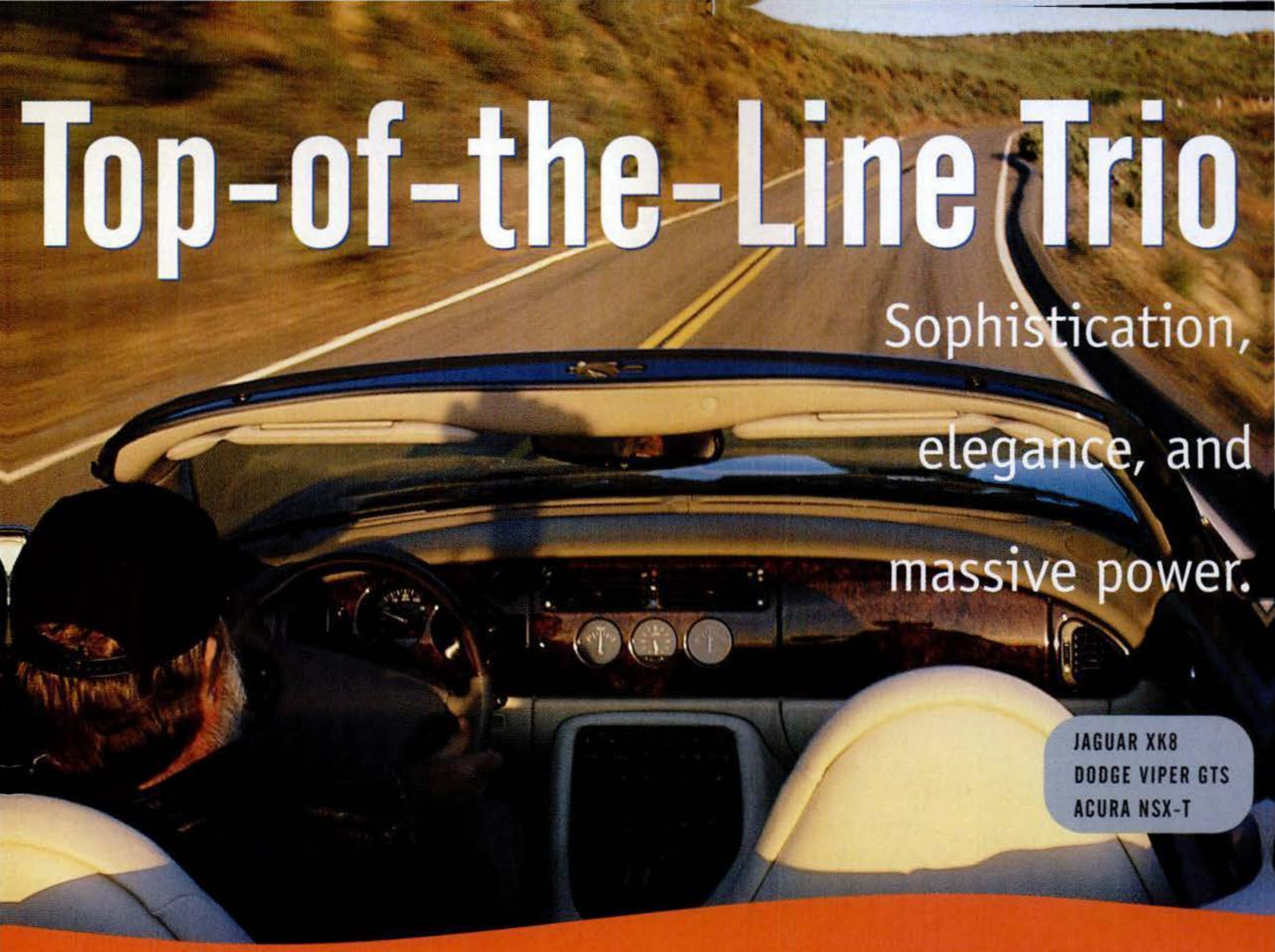
So instead of going back and forth trying to decide which is the best blade to buy, just pick up a set of Bosch Micro Edge Excel wiper blades. Call **1-888-TOP-BLADE** for a retailer near you.

The most advanced wiper system ever.

BOSCH®

Top-of-the-Line Trio

Sophistication, elegance, and massive power.



JAGUAR XK8
DODGE VIPER GTS
ACURA NSX-T

By Tony Swan

SPORTS CAR IS A VERY elastic term, and this trio provides a striking illustration of just how far those words will stretch when the price tag hits $70,000 and up.

The Acura NSX is the quintessence of engineering sophistication. The Jaguar XK8 is the personification of touring elegance. The Viper GTS Coupe is a raw-boned brute with only the thinnest veneer of civilization. In fact, the only real commonalities are high-speed capabilities—all will top 150 mph—and high-dollar window stickers.

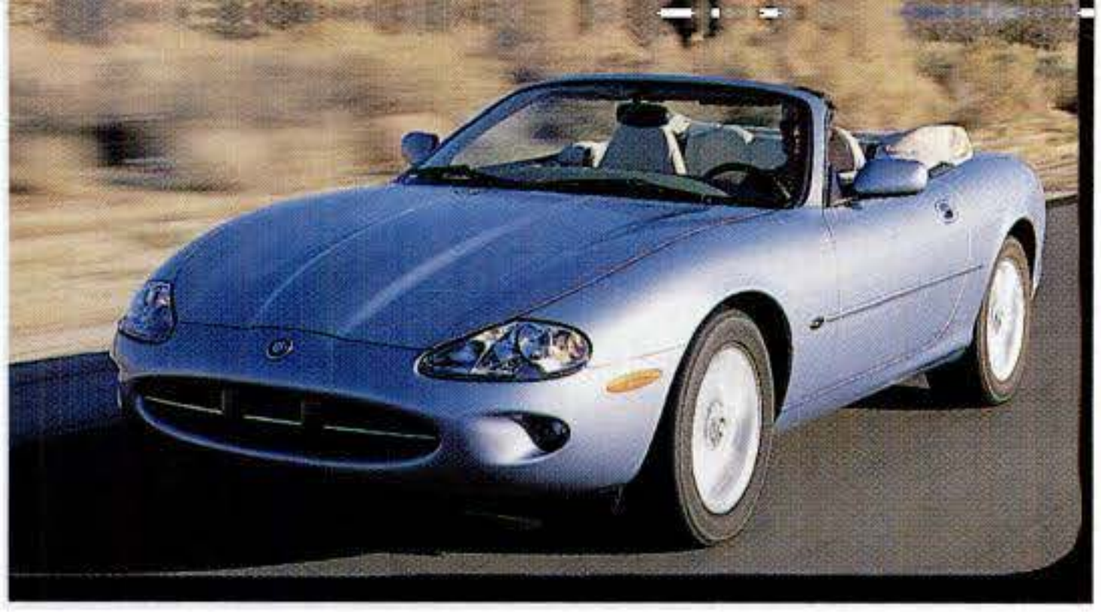
Beyond that, and seating for two (we dismiss the XK8's rear seat as a beautifully upholstered parcel shelf), these three couldn't be more different. On road or race track, each has a personality that sets it apart from the others—and from everything else.

Fresh from a mechanical overhaul for 1997, the NSX-T (the T distinguishes models with a removable roof panel) is the clear-cut techno-champ. Check the materials: aluminum control arms and hub carriers bolted to aluminum sub-frames front and rear; aluminum body panels; aluminum engine block and heads; titanium connecting rods. Honda's pursuit of mass reduction in this car has been relentless and extraordinary, yielding a curb weight of 3,120 pounds.

That's nine pounds heavier than the 1996 car, but it's far lighter than the others in this group. In models with manual transmissions, there's 20 horsepower more to propel the car—290 horsepower and 224 ft.-lbs. of torque from the new 3.2-liter V6.

Like so many Honda engines, the NSX V6 employs the VTEC variable cam timing system, and in this application the system starts working its max power magic at 5,700 rpm and peaks at 7,100 rpm, emitting an authoritative and engaging bark in the process. Power is controlled by a new drive-by-wire throttle system—no mechanical linkage—that responds to a pedal-position sensor, which actuates a step motor to feed the fires. Nestled just behind the seats, this superb piece of machinery is mated to a new six-speed manual transaxle.

The NSX was quickest among its economic peers, save for the vastly more powerful Viper GTS Coupe, but considering the inherent balance of a mid-engine design, herding it through the cones was surprisingly



Jaguar XK8

Jaguar manages to combine a contemporary powertrain, a bevy of traditional luxury features, and superb ride quality. Few driving experiences are more pleasant.

tricky. Although suspension travel is limited, the car exhibited a fair amount of body roll in quick maneuvers, and keeping its tail under control was difficult. In one particularly rapid turn, the tail end showed a definite inclination to precede the front. Despite its high skidpad number, we think this car could use a bigger rear tire.

The Viper GTS feels distinctly primitive compared with the NSX-T and XK8. For that matter, it feels primitive compared with most other cars.

Comfort isn't a word one readily associates with this car. The footwells are narrow, and there's no place for the driver to park his left foot. Other complaints: no glovebox; impossibly tiny audio controls; lots of interior noise; limited vision front and rear.

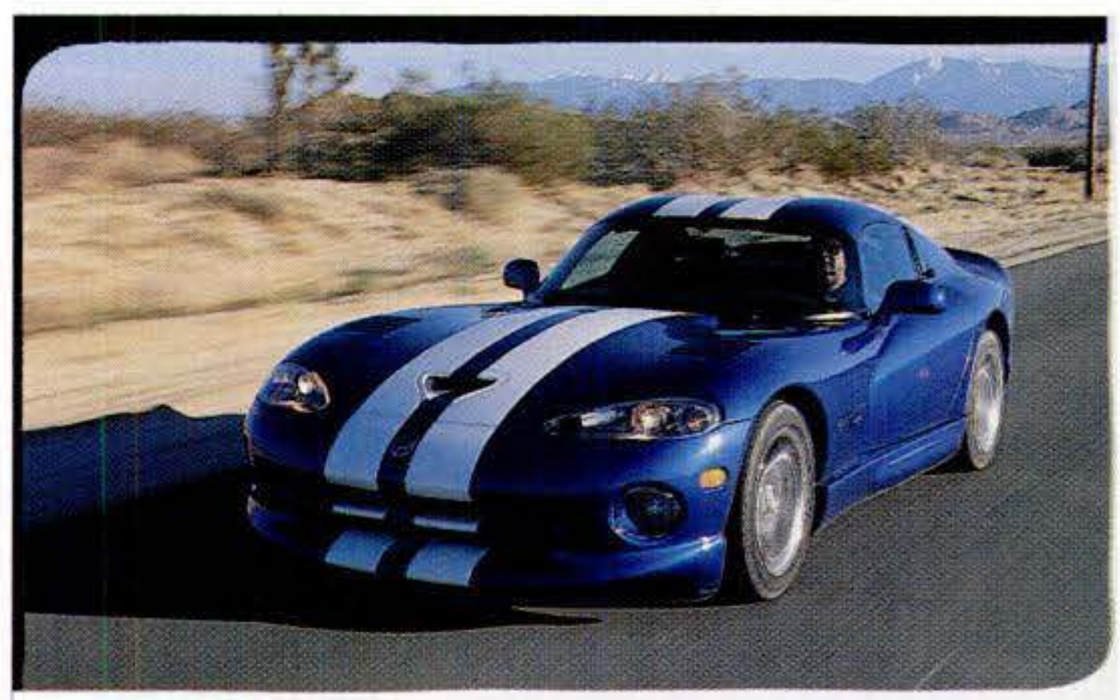
The Viper's tubular backbone space frame provides a flex-free platform ideal for a performance-oriented suspension system. The setup is essentially ultra-traditional racing fare: double A-arms; coil-over shocks; big vented disc brakes at all four corners. The pushrod V10 engine is an only-slightly-modern (thanks to its multiport injection and aluminum block and heads) manifestation of the '60s big-inch approach, pumping out 450 hp and 490 ft-lbs. of torque.

Does this sound like something you might want to take to a race track? You bet, and that's where the Viper left the others. It was the absolute champ on the Willow Springs road circuit and in instrumented test results, where power and grip prevail.

All that power is initially intimidating, but the Viper quickly proved to be the most confidence-inspiring performer in our group—well balanced, stable in high-speed turns, with useful oversteer in tight corners, plenty of braking power, and lots of grip. The best of its four laps

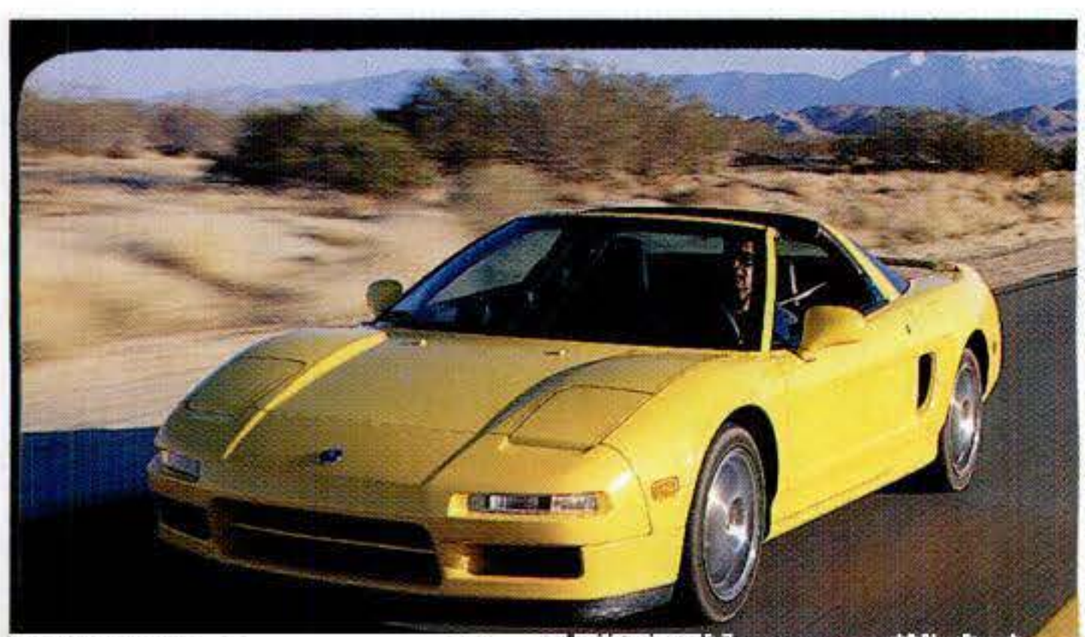
Dodge Viper GTS

The Viper has highly supportive bucket seats, and the adjustable foot pedals help civilize it. Yet the footwells are narrow and there's no glovebox.



Acura NSX-T

The NSX is a pleasurable companion—excellent forward sight lines, enhanced by the unusual forward-sloping dashboard design—and ride quality is surprisingly supple.



was four seconds quicker than the Acura's. It was clear that more seat time would only stretch this car's lead over the competition.

But real life is not a race track, and on public roads the Viper experience can become tiresome in a hurry.

Measured against the Acura and Viper, the Jaguar XK8 is more Grand Tourer than sports car. It's certainly fast enough, even with its standard five-speed automatic transmission, and it has excellent high-speed stability, plus world-class braking. Its handling is ponderous compared with that of its high-dollar rivals, but it's forgiving.

Unless you plan to attack every corner you encounter, however, few driving experiences are more pleasant than being behind the wheel of an XK8. Jaguar has done a masterful job of blending its traditional elegance with a contemporary powertrain, a bevy of luxury features, and superb ride quality. Jaguar's first V8 engine—a 4.0-liter

Copyrighted material

DOHC 32-valve aluminum design—produces 290 hp. The roadster's power top also is an engaging piece of design; one touch of the dashboard switch does it all, including latching and unlatching.

The bottom line: The Acura NSX is a cutting-edge, thoroughbred sports car, albeit a trifle touchy at times, and the Viper GTS proves to be an amazingly competent blast from the past. But for high-speed hedonism, swathed in walnut and leather, the Jaguar XK8 is in a class by itself. ◆

	BMW Z3 2.8	PORSCHE BOXSTER	ACURA NSX-T	DODGE VIPER GTS
ACCELERATION				
0-30 mph (sec.)	2.3	2.4	2.3	2.5	2.4	2.9	2.0
0-60 mph (sec.)	6.1	5.3	6.3	7.0	5.3	7.0	4.1
TOP GEAR PASSING							
30-50 mph (sec.)	7.4	14.0	9.6	3.2	7.9	3.2	8.8
50-70 mph (sec.)	7.3	12.8	9.3	4.3	7.5	4.0	9.0
HANDLING							
Road-holding (g)	0.89	0.91	0.87	0.88	0.91	0.85	0.97
600-foot slalom (mph)	49.4	49.4	50.4	50.1	49.4	46.8	50.8
Double-lane change (mph)	59.6	61.5	62.4	61.3	63.4	54.6	64.1
Willow Springs speed (mph)	89.7	93.1	89.7	89.6	92.0	88.5	96.2
60-0 MPH BRAKING							
Cold (ft.)	133	130	131	137	140	136	164
Warm (ft.)	130	129	132	124	134	135	158
Hot (ft.)	129	130	133	122	140	129	158
INTERIOR NOISE							
Idle (dBA)	49	57	55	50	46	50	68
60 mph (dBA)	70	68	72	66	72	65	77
0-60 mph (dBA)	77	81	82	73	85	74	86
EPA MILEAGE							
City/Highway (mpg)	19/27	18/28	19/27	22/30	17/24	17/24	11/21
POWERTRAIN							
Engine	2.8-liter DOHC inline 6	5.7-liter V8	2.5-liter DOHC flat 6	2.3-liter DOHC I4	3.2-liter DOHC V6	4.0-liter DOHC V8	8.0-liter V10
Valves/cylinder	4	2	4	4	4	4	2
Power (hp @ rpm)	189 @ 5,300	345 @ 5,600	201 @ 6,000	185 @ 5,300	290 @ 7,100	290 @ 6,100	450 @ 5,200
Torque (lb.-ft. @ rpm)	203 @ 3,950	350 @ 4,400	181 @ 4,500	200 @ 2,500	224 @ 5,500	284 @ 4,200	490 @ 3,700
Transmission	5-speed manual	6-speed manual	5-speed manual	5-speed automatic	6-speed manual	5-speed automatic	6-speed manual
CHASSIS							
Front suspension	strut-type, coil springs	control arms, fiberglass leaf spring	strut-type, coil springs	control arms, coil springs	control arms, coil springs	control arms, coil springs	control arms, coil springs
Rear suspension	semi-trailing arm, coil springs	control arms, fiberglass leaf spring	strut-type, coil springs	multilink, coil springs	control arms, coil springs	control arms, coil springs	control arms, coil springs
Brakes, f/r	vented disc/disc	vented disc/ vented disc	vented disc/ vented disc	vented disc/ disc	vented disc/ vented disc	vented disc/ vented disc	vented disc/ vented disc
ABS	4-channel	4-channel	4-channel	4-channel	4-channel	4-channel	None
DIMENSIONS							
Wheelbase (in.)	96.3	104.5	95.2	94.5	99.6	101.9	96.2
Length (in.)	158.5	179.7	171.0	157.3	174.2	187.4	176.7
Width (in.)	68.5	73.6	70.1	67.5	71.3	72.0	75.7
Height (in.)	50.9	47.7	50.8	50.8	46.1	51.4	47.0
Curb weight (lbs.)	2,900	3,260	2,900	3,040	3,120	3,940	3,460
Fr./rear distrib. (%)	52/48	52/48	46/54	53/47	42/58	50/50	49/51
Headroom (in.)	37.6	37.8	38.0	37.4	36.3	37.0	36.9
Legroom (in.)	41.8	42.7	41.6	42.7	44.3	43.0	42.6
Shoulder room (in.)	51.7	55.3	Not available	51.7	52.5	55.2	53.8
Passenger volume (cu. ft.)	47.0	51.7	47.0	47.8	48.9	69.5	49.0
Trunk volume (cu. ft.)	5.0	25.0	9.1	9.5 (top up)	5.0	9.5	9.0
Fuel tank (gal.)	13.5	19.1	15.3	14.0	18.5	19.9	19.0
PRICES							
Base price	$36,470	$38,060	$40,745	$40,295	$88,725	$70,480	$69,700
Price as tested	$38,145	$43,679	$43,941	$42,390	$88,725	$74,280	$71,200
Major options	leather upholstery, $1,200; metallic paint, $475	variable shock absorbers, $1,695; manual transmission, $815; transparent roof panel, $650; sports seats; $625	sport package, $3,245; leather seat trim, $1,951	cellular phone and CD changer, $1,495; metallic paint, $600	None	traction control, $2,000; metallic paint, $1,000; CD changer, $800	blue/white paint, $1,200; polished aluminum wheels, $300

CHEVROLET CORVETTE

MERCEDES-BENZ SLK230

JAGUAR XK8

Copyrighted material

SERIOUS FREEDOM

NEW EAGLE F1.

ADRENALINE ON WHEELS.

This is what you call Serious Freedom. Freedom to sit back and enjoy the rush. Freedom that comes from knowing you have race-bred dual aquachannels sweeping water aside for superb wet traction. And knowing that new Eagle F1 comes from the engineers that created Formula One and Indy car racing Eagles. Serious traction. Discover it with new Eagle F1. Only from Goodyear.

- *Race-bred dual-aquachannel tread pattern and multi-radius cross section.*
- *Exclusive Goodyear AATRAX™ tread compound.*
- *UTQG AA wet-traction rating.*
- *Our quietest ultra-high-performance tire yet.*

Call 1-800-GOODYEAR for a location near you.
Web site: www.goodyear.com

GOODYEAR
#1 in Tires

Copyrighted material

FYI

EDITED BY CECILIA WESSNER

ASK POPULAR SCIENCE

On "Star Trek," the captain sometimes orders the Enterprise to come to a "full stop." Can a spaceship really come to a full stop in space?

Geoff Coles
Mississauga, Canada

THE ANSWER IS NO. But a 19th century physicist would have said yes. After Einstein, our notions of space and time changed forever.

First, you must specify the object with respect to which you have stopped. If you are stopped at a stop sign then with respect to that sign, you are not changing position. You're still in motion, however, because Earth spins on its axis and rotates around the sun. The sun, too, is in motion with respect to other stars. Thus, being at rest makes sense only if you specify with respect to what. Physicists call this defining your reference frame. This raises another question: Is there a perfect, or absolute, reference frame that stays put while everything else moves?

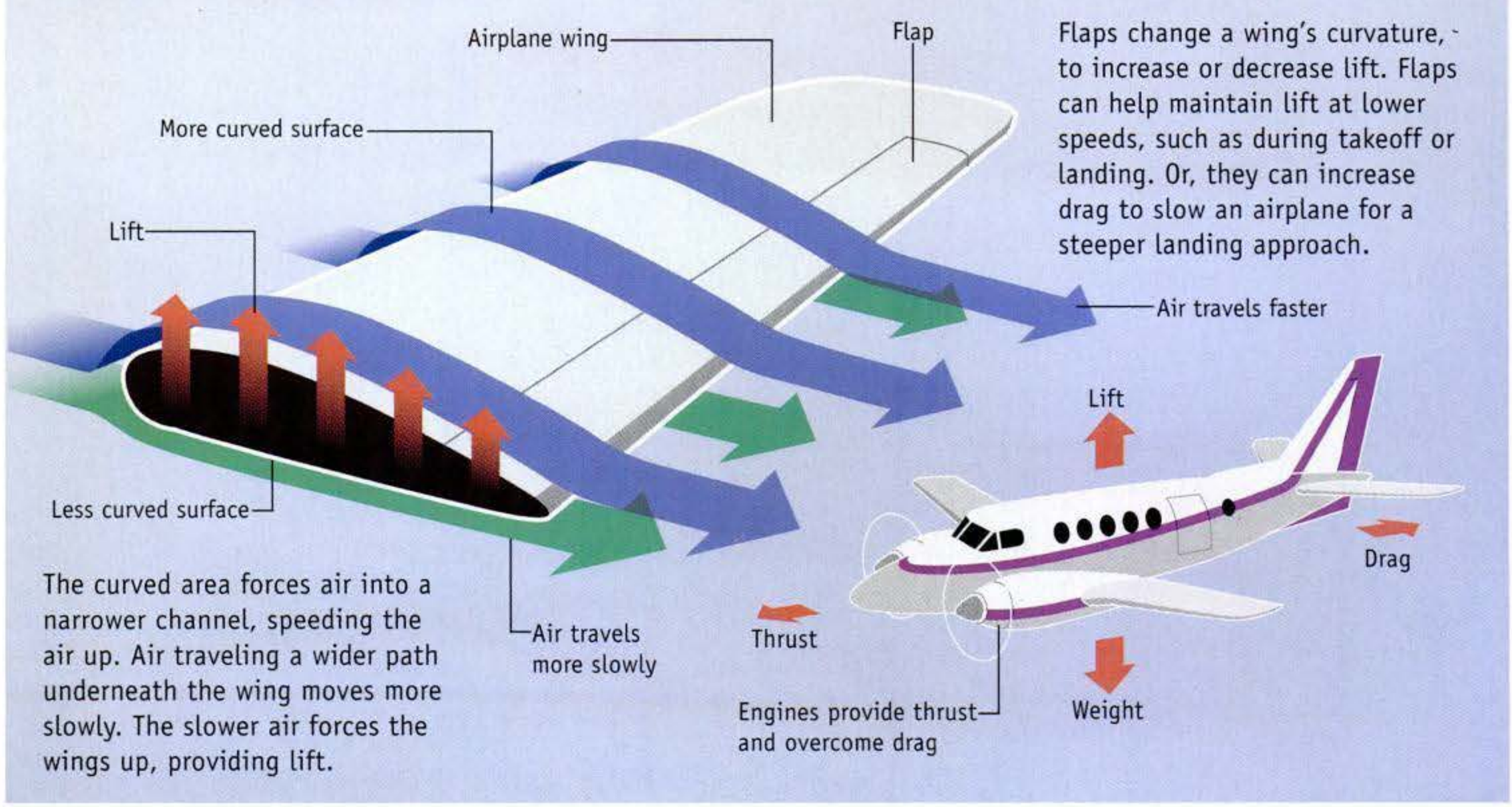
Newton believed that space itself was absolute and forever static. Thus you could indeed come to a full stop with respect to this absolute space, and you could sit still and watch everything else move. Physicists call this an inertial reference frame. Newton also held that time was absolute and should flow at the same rate for everyone.

Newton's beliefs about absolute space and time ran into trouble in the late 19th century, as experiments began to contradict his ideas. In 1905, Einstein proposed that space and

HOW IT WORKS

Airplane Flight

THEY FLY THROUGH THE AIR with the greatest of ease. But unlike trapeze artists, airplanes soar with no strings attached. How? Their wings make use of an upward force called lift. To create lift, the engines push the aircraft forward, providing thrust. Thrust overcomes the resistance of air, called drag, once the aircraft is in flight.—*Mariette DiChristina*



Flaps change a wing's curvature, to increase or decrease lift. Flaps can help maintain lift at lower speeds, such as during takeoff or landing. Or, they can increase drag to slow an airplane for a steeper landing approach.

The curved area forces air into a narrower channel, speeding the air up. Air traveling a wider path underneath the wing moves more slowly. The slower air forces the wings up, providing lift.

GREG MAXSON

Copyrighted material

Set six AM and six FM stations.

Easily connect your CD player, cassette player, TV, or VCR.

HEAR WHY THE BOSE® WAVE® RADIO WAS NAMED A "BEST NEW PRODUCT OF 1994" BY *BUSINESS WEEK*.

Tabletop radios are popular for their convenience and small size. But their sound quality leaves much to be desired. No one really expects high-fidelity sound from a radio. Until now.

Bose presents the Wave radio. It's the one radio acclaimed by leading audio critics. Because it's the one radio is our patented acoustic waveguide speaker technology. Just as a flute strengthens a breath of air to fill an entire concert hall, the waveguide produces room-filling sound from a small enclosure. This technology and performance is available in no other radio.

You'll touch a button and hear your favorite music come alive in rich stereo sound. You'll hear every note the way it's *meant* to be heard. The Wave radio measures just 4.5"H × 14"W × 8"D and fits almost anywhere. So you can listen in your bedroom, living room, kitchen, or any room.

CALL NOW AND MAKE SIX INTEREST-FREE PAYMENTS.

The Wave radio is available for $349 directly from Bose, the most respected name in sound. Call 1-800-845-BOSE, ext. R4668, or return the coupon for free information or to learn more about our in-home trial and satisfaction guarantee. When you call, ask about our six-month installment payment plan.

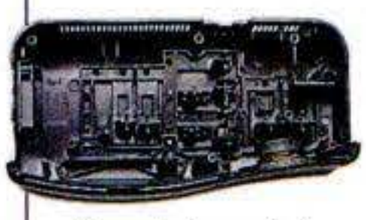
Wired magazine said it has a "clean, sweet sound that will have your friends wondering where you've hidden your fancy speakers." But you have to hear the Wave radio for yourself to believe it. Call today.

HEAR THE RADIO THAT WOKE UP AN ENTIRE INDUSTRY.

that delivers big, rich, lifelike stereo sound *plus* a small, convenient size.

THE BEST-SOUNDING RADIO YOU CAN BUY.

We think the Wave radio is the best sounding radio you can buy. And audio critics agree.



The speakers in conventional radios cannot produce lifelike bass, which is essential for great sound.

Only the Wave radio with acoustic waveguide speaker technology produces high-quality sound with full, rich bass.

Radio World called the sound "simply amazing...a genuine breakthrough in improved sound quality." *Business Week* named the Wave radio a "Best New Product of 1994." *Popular Science* called it "a sonic marvel" and gave it a prestigious "Best of What's New" award. The key

REMOTE-CONTROLLED CONVENIENCE.

Operate the radio from across the room with the credit card-sized remote control. Set six AM and six FM stations, and switch between them at the touch of a button. You can even bring great Bose sound to recorded music, TV programs, or movies by connecting the Wave radio to your CD or cassette player, TV, or VCR.

CALL 1-800-845-BOSE, EXT. R4668.

When you call, ask about our six-month installment payment plan. (Available on telephone orders only.) Also ask about FedEx® delivery.

Please specify your color choice when ordering the Wave® radio:

☐ Pearl White ☐ Graphite Gray

Mr./Mrs./Ms.
Name (Please Print)

Address

City State Zip

( )
Daytime Telephone

( )
Evening Telephone

Mail to: Bose® Corporation, Dept. CDD-R4668, The Mountain, Framingham, MA 01701-9168, or fax to 1-508-485-4577.

BOSE®
Better sound through research®

©1997 Bose Corporation. Covered by patent rights issued and/or pending. Installment payment plan option is not to be used in combination with any other offers. Price and/or payment plan are subject to change without notice. *Wired*, June 1994.

Copyrighted material

time were relative and could change, depending on an observer's motion. One consequence of this idea is that the universe, or space itself, is expanding. That means there is no place to stay at rest—only constant change in an expanding universe. Einstein's theories have passed every test devised to discredit them, so far.

Still, we're sure the captain must have studied relativity in Starfleet. So when he says "full stop," it's understood by his crew that he means stopping only with respect to something else, be it a planet or another ship.

How does bulletproof glass work?
frank@biruni.erum.com.pk

NOTHING IS bullet*proof*, say experts at Viracon, a manufacturer of safety glass products in Owatonna, Minnesota. Different glass-and-plastic configurations provide different levels of bullet *resistance*.

Safety glass is typically made using three materials: all-glass, all-plastic, and combinations of glass and plastic. To create a bullet-resistant window, several layers of glass or polycarbonate plastic are laminated together with a thin plastic film that acts as a glue. For a bullet to pierce these windows, it must crack or shatter each layer.

Independent laboratories rate safety glass according to eight different levels of protection. The lowest level should be able to protect against a few hard blows to the window. This is sometimes referred to as a "smash-and-grab" threat. Slightly higher levels of protection are designed to stop a bullet fired from, say, a small handgun. The two highest levels indicate glass strong enough to stop fire from military rifles, or other intense physical assaults. These high-level windows, used in embassies and courthouses, for example, are typically made with a layer of glass, then an air space, then laminated layers of glass and plastic. These windows can be as thick as 2½ inches and cost more than $100 per square foot. In comparison, homeowners can purchase "smash-and-grab" level protection for approximately $3 to $5 per square foot above the cost of the window.

Got Kids Who Watch TV?

TUNE IN TO the **Pop Sci for Kids** show, from the editors of POPULAR SCIENCE, on the Discovery Channel this month.

• Sunday, May 18, 11:30 a.m.

IN SEARCH OF BIGFOOT
IS A HAIRY, eight-foot-tall, 400-pound animal at large in the forests of the Pacific Northwest? Reports of sightings of the legendary Bigfoot keep the telephone ringing at the Bigfoot Research Project in Mount Hood, Oregon. Peter Byrne, director of the project, has spent the last 17 years searching for Sasquatch. He takes you out on the trail, where surveillance cameras await the arrival of the mysterious beast.

RE-BUILDING BRIDGES
A BILLION-dollar retrofitting project is underway on the San Francisco Bay Bridge, the busiest in the country. The bridge, which collapsed under a 7.0 quake in 1990, is located in one of the most earthquake-active areas of the world. Strengthening members are being added; the west end of the bridge will be able to withstand an 8.0 quake, and the east will handle a quake that rates 7.3.

• Sunday, May 25, 11:30 a.m.

BOMB STOPPERS
MEET THE experts in one of the world's most dangerous professions: The Boston Bomb Squad, a group of former military explosives experts and firefighters who protect most of New England from bomb threats. They demonstrate lessons in the science of disarming explosives, letting you peek over their shoulders as they dismantle an actual bomb. What does it take to do this job, and how do the experts protect themselves and others from hazards?

ARE WE ALONE IN THE UNIVERSE?
NO SOLID evidence yet exists for extraterrestrial life, but that doesn't stop researchers from exploring the possibilities. Seattle's National UFO Reporting Center and the Center for Extraterrestrial Life in Mountain View, California, consider the evidence being gathered to support theories that we are not alone in the universe.

• Sunday, June 1, 11:30 a.m.

THE DINOSAUR HUNTER
MEET JACK Horner, curator of paleontology at the Museum of the Rockies in Bozeman, Montana. Horner, the technical advisor on *Jurassic Park*, is currently working on the sequel, *The Lost World*. The celebrated dinosaur scientist offers a look at such discoveries as the largest dinosaur nesting ground in the world and the similarities between dinosaurs and birds.

BICYCLE COPS
ON THE WINDING, traffic-snarled streets of San Francisco, police are finding that modified mountain bikes can weave through congestion and patrol areas where four-wheeled police cruisers cannot venture.

THE ULTIMATE DRIVING MACHINE
THE FASTEST production car in the world, the McLaren F1 road car, reaches speeds of 235 mph. You'll visit the assembly plant and then see this screamer burn up the country roads outside London.

Copyrighted material

What is antimatter?

Chris Anderson
Williamstown, W.V.
anders6@juno.com

MOST OF THE universe is made up of the ordinary form of matter with which we are all familiar—a whole catalog of so-called elementary particles that have specific properties such as mass, charge, and spin. An atom of ordinary hydrogen, for example, consists of a positively charged proton in the nucleus and a negatively charged electron orbiting around it.

But for every particle in the

POLL RESULTS

September 1996 Poll Results

"Should high-school students be required to achieve a minimum level of computer compentency in order to graduate?"

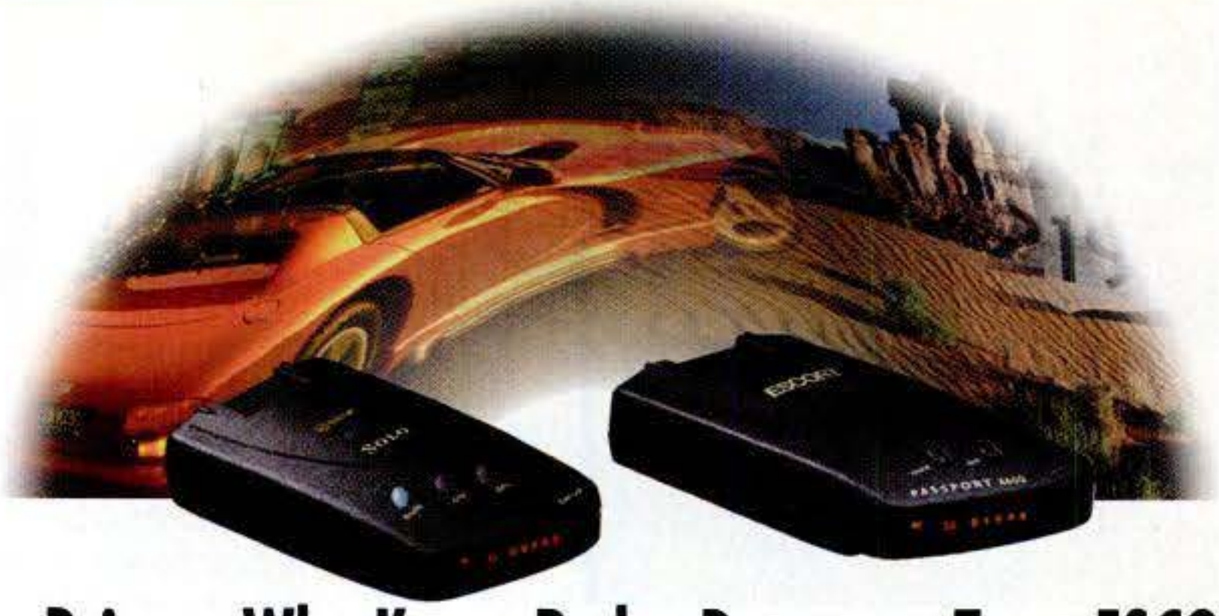
Here are the results:

74.7% **say computer compentency should be required**

17.2% **say computer compentency should not be required**

8.1% **are not sure if there should be a requirement**

The September results show the widest margin between the "yes" and "no" responses of any poll we've conducted thus far. The few naysayers commented that before students become competent with computers, they need to learn the three R's and develop critical thinking skills. Readers in favor of a minimum competency requirement claim that students would be left behind in the job market without computer skills. A few readers compared computer skills with the three R's, with one saying that they are actually the same thing in today's world. But one reader may have summed up the "yes" responses best with this greeting: "Welcome to the 21st century."



Why Drivers Who Know Radar Detectors Trust ESCORT®

(and how you can get ESCORT performance yourself)

There is no more valuable name in the industry than ESCORT. We've earned the confidence of millions of drivers with the most intelligent performance on the road.

HIGHEST ALERT ACCURACY
It's no accident that ESCORTs are used more faithfully by their owners than any other brand. With the industry's most coveted anti-falsing design, ESCORT gives you the absolute highest ratio of true alerts for information you can depend on.

DRIVER FRIENDLY DESIGN
ESCORT has the most easy-to-use detectors you'll find. ESCORT alerts are instinctive. Every feature is tested for utility and simplicity to keep you using – and enjoying – your ESCORT at all times.

SMART CHOICES
With ESCORT's two excellent models, it's simple to choose a detector for your driving needs. PASSPORT 4600 is a proven favorite with drivers everywhere. New Cordless SOLO is the world's most advanced detector with ultimate mobility and exclusive Programmable Options.

SUPERIOR VALUE
Only ESCORT can provide such winning products at such intelligent prices. Can you afford not to drive with ESCORT? Order today.

SOLO® $199.95 PASSPORT® 4600 $179.95

30-Day No-Risk Trial
Ship/Handling extra. OH res. add 6% sales tax.
Web site: http://www.escortstore.com/

ESCORT®
1.800.433.3487
5200 Fields Ertel Rd. Cincinnati, OH 45249
Department 501637

© 1997 CMI

FREE VIDEO

Reveals How You Can Benefit from the Exploding Steel Framed Home Industry!

Build your next home or business with the 20-year leader in steel homes.

Tri-Steel makes it easy with:
- Three unique steel framing systems
- Hands-on training workshops
- Construction and technical assistance
- Unrestricted territories
- No franchise fees or inventory
- Substantial discounts
- Single or multifamily and commercial

Tri-Steel Homes feature:
- Pre-engineered framing for simple bolt or screw together construction
- Unmatched protection from fire, high winds, termites, and even earthquakes
- Energy efficient 9" (R-30) insulation
- 150+ standard models or custom designs
- Open, versatile clearspan interiors

DISTRIBUTORS WANTED in Select Areas

Call today to order a FREE Information Packet, plus the FREE VIDEO (with refundable $10 deposit.)

Attend a Steel Home Seminar! Call for locations and dates.

Call Tri-Steel Headquarters toll free at:
1-800-TRI-STEEL, *Operator 227*
(800) 874-7833 (817) 497-7070 Fax: (817) 497-7497
5400 S. STEMMONS FRY., DENTON, TX 76205

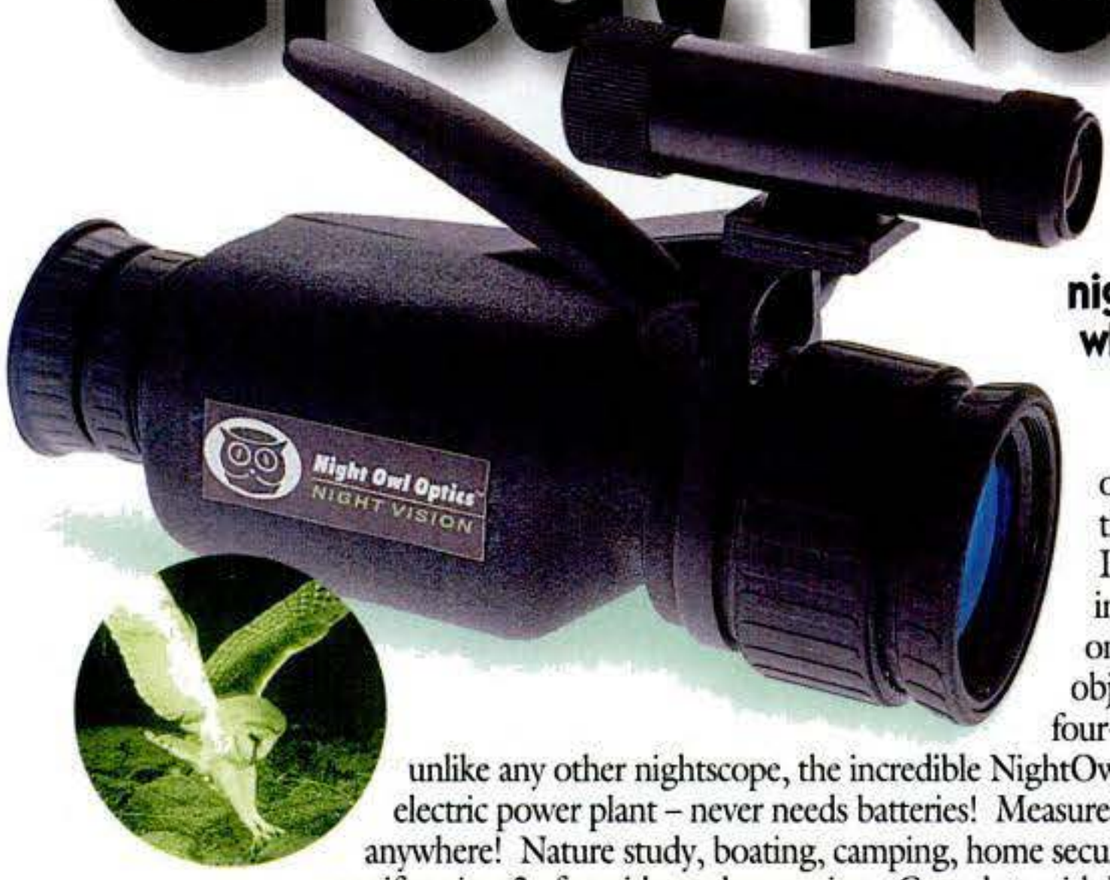
Tri-Steel Structures, Inc.

In S.E., call Tri-Steel in GA toll free at:
1-888-252-6654, *Operator 227*
(770) 483-3003 Fax: (770) 483-0014
882 MAIN ST. CONYERS, GA 30207

© 1997, All Rights Reserved

Copyrighted material

Great New Products



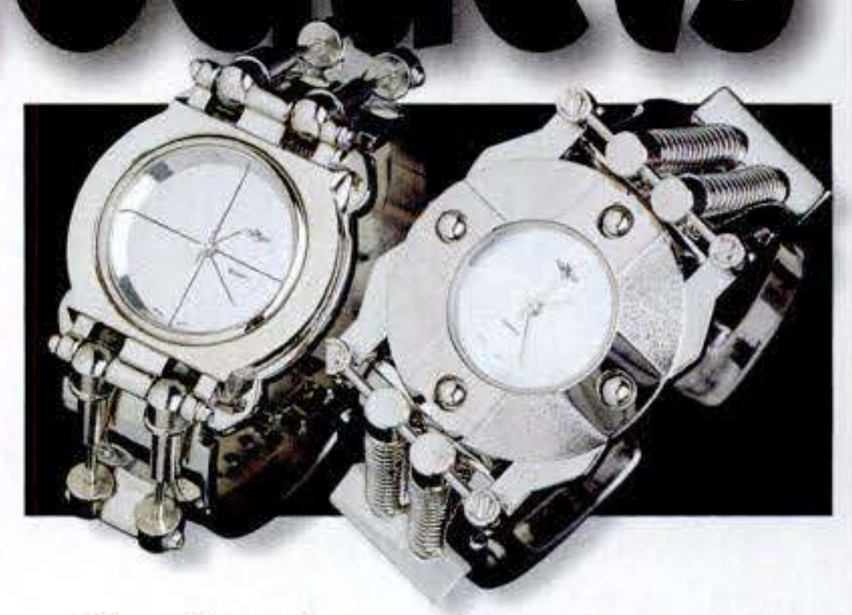
Lever-action night-scope keeps going when others fail. Never needs batteries!

You hear a noise outside. See only inky darkness. Now press the lever of the new NightOwl. Instantly your yard or camp is lit in green-hued daylight – which only you can see! Pick out every object, every tree, every animal, four-legged or otherwise. Plus unlike any other nightscope, the incredible NightOwl utilizes a revolutionary piezo-electric power plant – never needs batteries! Measures just 2½" by 6", take it anywhere! Nature study, boating, camping, home security or working at night. Also magnifies view 2x for wide angle scanning. Complete with black carry case.

- **Lever-Action NightOwl Scope, #NV-PL2 $299.95**

For total blackness (or inside) where there is no light to amplify, add the battery powered optional infrared illuminator shown mounted above. Bathes your view out to 100' with light only you can see!

- **Micro-Illuminator for NightOwl, #NV-PLIL $29.95**



Gleaming robo-watches get you more compliments than any other built by man or machine.

The liquid-like chrome finish of our new Machina watches look exceptional from boardroom to bar-room. Put one on. Spring and pistons compress and release. Japanese quartz movement is precise to the second. Mineral crystals are scratch resistant. Stainless, dust, shock, and abuse proof. Each in a gift box. Welcome to the machine.

- **Machina Watch, pistons, #9311B $39.95**
- **Machina Watch, springs, #9430 $39.95**

Anti-Bugging
Anti-Recording
Anti-Line Cutting
Unauthorized Dialing
Intercom Privacy

Not only tells you when your calls are monitored – jams the listener device, too! Even stops recorders cold!

Competitors listening in on business calls. Investigators eavesdropping on calls. Couldn't happen to you? Consider this: private detectives report a banner year. Technology outrunning privacy. Even the government can legally tap your phone. Why be next? Teleguarder takes a quantum leap beyond ordinary tap detectors. Not only alerts you to bugs, it jams them to oblivion! For instance, if an automatic machine is taping your calls, Teleguarder turns it off. Bugs, taps, even extensions are rendered inoperable. Installs in seconds. Click in the modular connectors and then ignore it. Completely automatic, insuring that your calls are private, and frustrating all would-be listeners.

In this day and age of lawsuits, and competitive business, why take chances? Teleguarder costs you far less than the price of being overheard.

- **Teleguarder Privacy Controller #CL-208 $119.95**

NEW DYNAFLEX STRENGTH MACHINE.

Powers up with the rising pitch of an F-18 fighter – with no batteries, no motor. Yet we dare you to hold on to it!

Give it a quick pull or thumb flick to get it moving. Rotate your hand. It starts to race and hum. Soon its whirling at over 9,000 revolutions per minute! Meanwhile, your wrists, grip, and arm are straining and working out against a powerhouse gyroscopic action. In fact, Dynaflex is now spinning internally so fast that it wants to leap out of your hand! Need a break? Pass it to an unsuspecting friend. Watch them try to hold onto it! As an executive relaxer, a carpal-tunnel/arthritis reliever, or a strength and coordination builder, DynaFlex will knock your socks off!

- **DynaFlex Strength Machine, #DF-1000 $21.95**
- **The Ultimate Challenge – try holding two! #DF-PAIR $34.90 Save $9.00.**

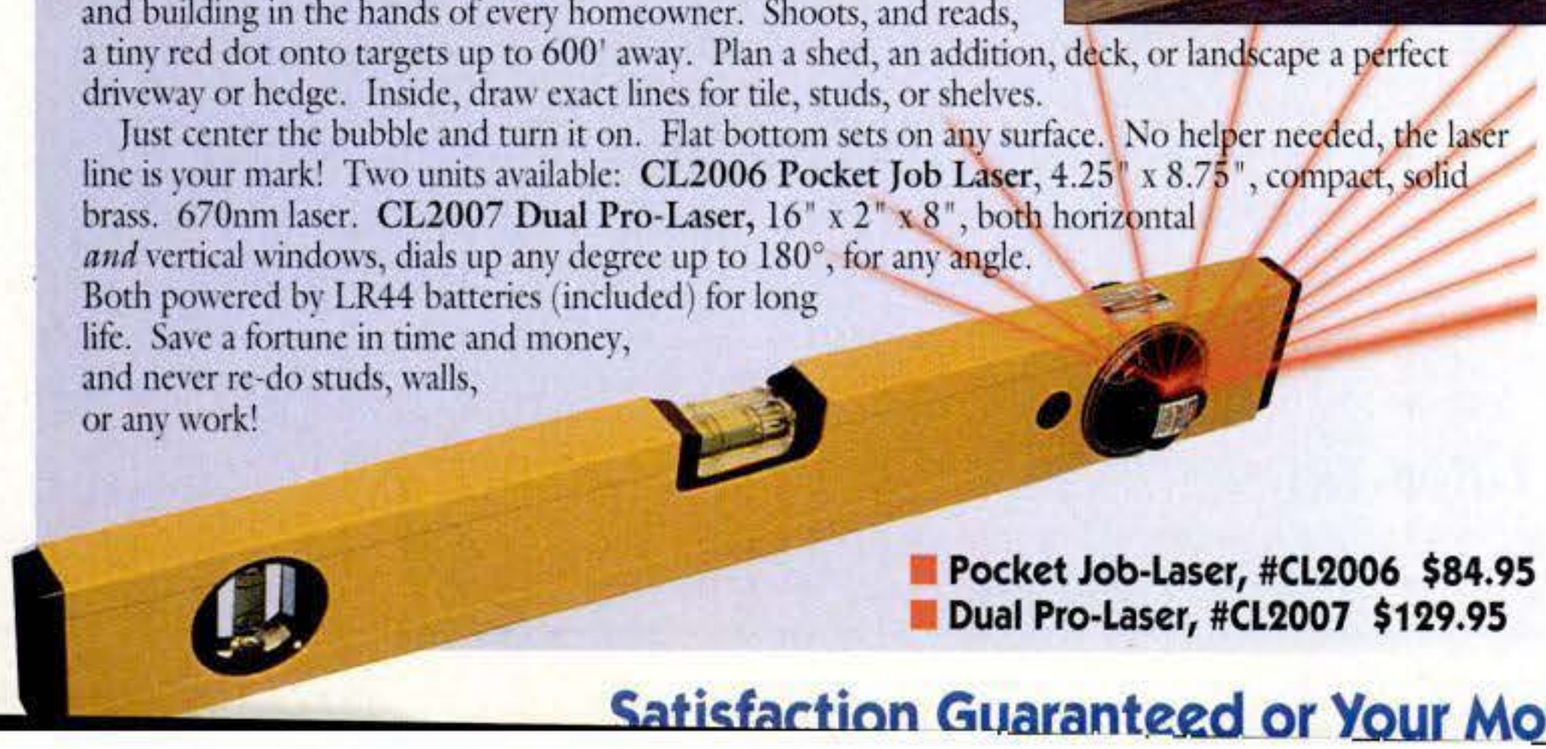
Will my deck drain correctly? Kitchen cabinets square? Newest job-lasers give you instant answers!

Level kitchen cabinets. Lay out a prefect garden or stone wall. Measure heights/angles across a field or room. Square up a slab or foundation – before you pour!

Building a deck, extending a fence, hanging pictures or cabinets? Now do it quicker than pros – even working single-handed!

New miniaturized technology puts affordable, precision leveling and building in the hands of every homeowner. Shoots, and reads, a tiny red dot onto targets up to 600' away. Plan a shed, an addition, deck, or landscape a perfect driveway or hedge. Inside, draw exact lines for tile, studs, or shelves.

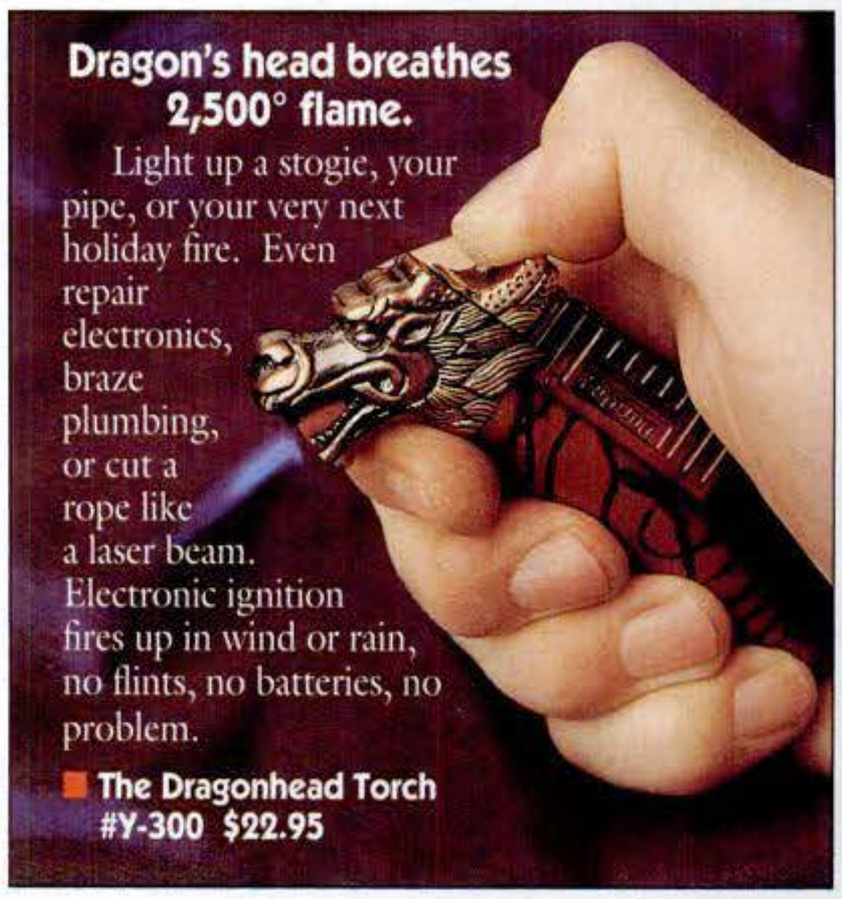
Just center the bubble and turn it on. Flat bottom sets on any surface. No helper needed, the laser line is your mark! Two units available: **CL2006 Pocket Job Laser**, 4.25" x 8.75", compact, solid brass. 670nm laser. **CL2007 Dual Pro-Laser,** 16" x 2" x 8", both horizontal *and* vertical windows, dials up any degree up to 180°, for any angle. Both powered by LR44 batteries (included) for long life. Save a fortune in time and money, and never re-do studs, walls, or any work!



- **Pocket Job-Laser, #CL2006 $84.95**
- **Dual Pro-Laser, #CL2007 $129.95**

Dragon's head breathes 2,500° flame.

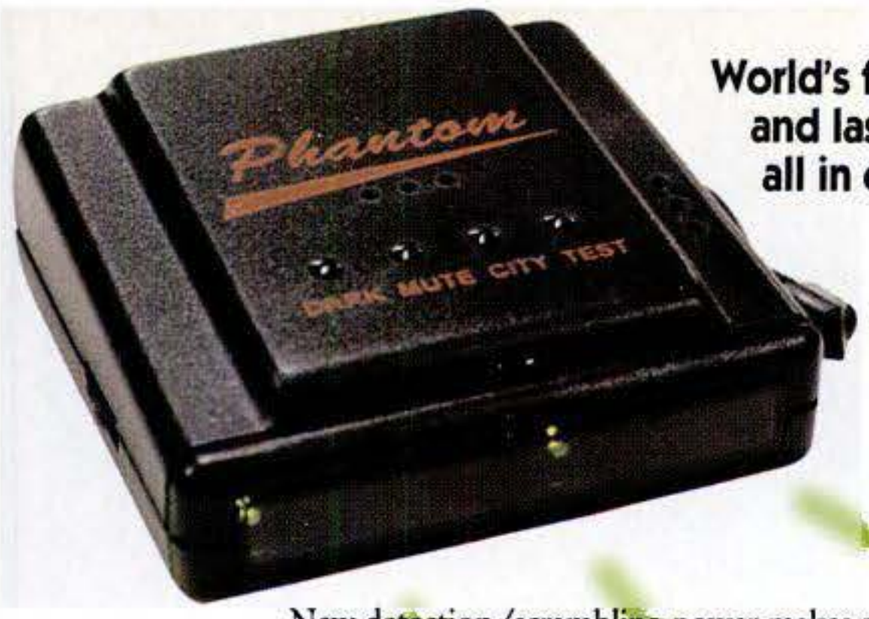
Light up a stogie, your pipe, or your very next holiday fire. Even repair electronics, braze plumbing, or cut a rope like a laser beam. Electronic ignition fires up in wind or rain, no flints, no batteries, no problem.



- **The Dragonhead Torch #Y-300 $22.95**

Satisfaction Guaranteed or Your Money Back.

Copyrighted material



World's first radar detector and laser/radar scrambler all in one! Renders your car invisible.

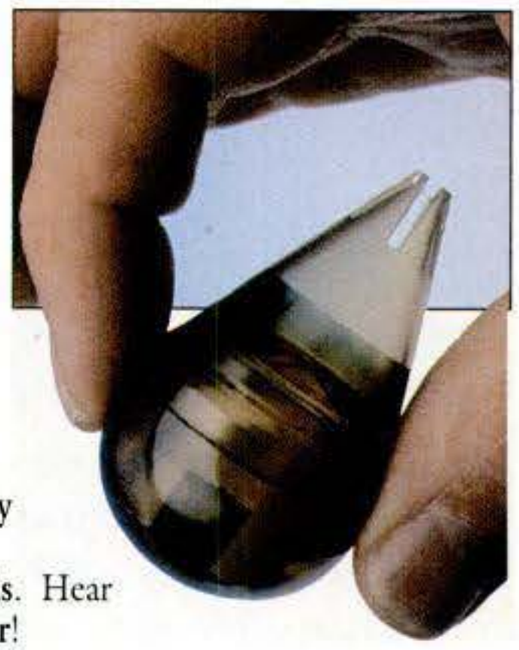
You can't catch what you can't see!

New detection/scrambling power makes speed-traps near obsolete! Tests proved it: the Phantom alerts you to radar up to 4 miles out, *and* turns the signal to useless trash! Lasers? Phantom transmits I.R. beams to eliminate your image. They can hunt you by car, speed-trap, even helicopter, but you're simply not there. Because Phantom is a passive system, it's completely legal! Indicators tells you type and range of police equipment. Adjust for dark, mute, city/hwy, and sensitivity. X, K, Ka, and VG-2 protection. Complete with warranty, windshield mount and power cord. So effective, if you ever get a ticket the manufacturer will pay it for you!

■ **The Phantom Detector/Jammer Device, #RP-200 $299.95**

Measures just 4" x 4" x 1.5" H. Certain restrictions apply on ticket rebate program, to insure you do not intentionally drive recklessly. Not available where prohibited by law.

Battle-tested in Iraq. PowerTip boosts reception and range of all your wireless equipment.



Planes roared overhead. The battle raged. All while this ingenious copper device, on our tank antennas, increased the clarity of our combat communications. Now does the same for your cellphone, your car or home radio, even your cordless house phone!

Slip it onto the tip of any antenna. (Compression grip works with all.) Correctly coiled copper mass acts like a wave-length "magnet", dramatically boosting weak signals. Hear crystal-clear. Add new power to all your gear!

■ **PowerTip Signal Booster, #PT-500 $18.95**

■ **Two for just $14.95 each, #PT-SET $29.90**

•CAR RADIOS •CELL PHONES •BOOM BOXES •RABBIT EARS •STEREOS

As used on our tanks and APC's in Desert Storm

Astronomers fold super-power reflecting scope into 7¼ inches!

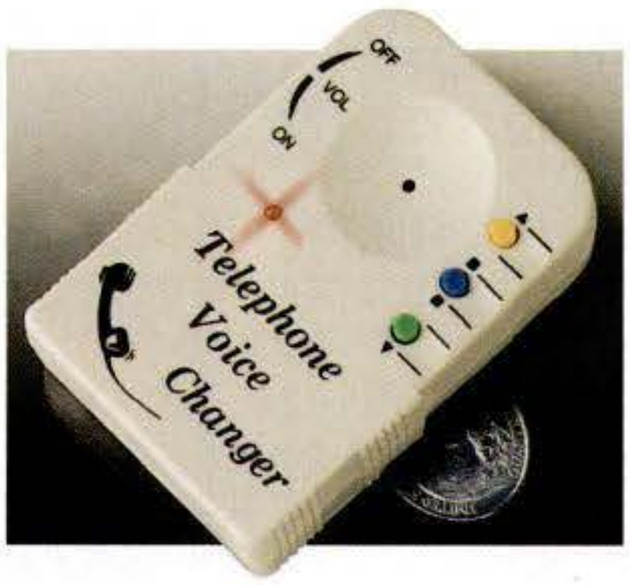
The most powerful telescopes use giant reflecting mirrors to *fold* the light path, so they can range billions of miles to the very edges of the universe. The Cat-Scope not only miniaturizes these celestial explorers, but folds the light path *twice*. Enjoy the power of cannon-sized scopes in the palm of your hand!

Enormous 20x magnification and superb low-light performance. Study rock formations on the moon, or rooms in a building far away. Oversized objective lens and precision coated lens system give you *hairline* definition. Focus from infinity to as close as 10 yards! Rubber armor-coating takes the abuse and moisture that lesser scopes can't.

Boating, nature study, astronomy, hiking, concerts, or sports events – the release of top-secret space-race technology now gives you unequalled observation and surveillance power.

■ **Dual Reflecting Rubber-Armored 20x Cat Scope #BC-500 $89.95**

Weighs just 13.6 oz. Measures 7¼" x 2⅛". Complete with lifetime warranty.



Sorry, Mr. Jones is not in. This is Lucille, his secretary, may I help you?

New micro-size voice disguiser even works with pay phones.

Here's just some of the things you can do with our new palm-sized voice changer: fool your friends, confuse your enemies, be your own secretary, make anonymous calls for business or security reasons, or protect women and children home alone.

Unlike our desk-top voice-changers, the Micro-Disguiser has no modular hook-ups! Slip it from your pocket and place it over any phone's mouth piece! Miniature electronics alter your voice through three mechanical toned scales, high to low. Extreme settings sound hilarious, and mid-range will fool your own mother. Try one!

■ **Shirt Pocket Micro Voice-Disguiser #VC-168 $39.95**

Get one for your wife, too, and let harrassing callers think a mighty odd sounding man is at home.

Own the most hassle-busting tool ever invented.

Just push the Gator Grip over any nut, turn, and feel it snap free. Gator Grip's revolutionary socket multi-rods are spring driven. Conform and lock onto any shape. Rods adjust automatically, reset when you're done. Even rusted, broken, stripped, or frozen nuts give way to Gator Grip. Eye-nuts, hexes, oddballs, no problem. Plus, unlike square-pin imitators, Gator Grip's round-rods will not slip, and will not strip nuts. You save a fortune on other tools, and band-aids, too. Replaces all other wrenches ¼" to ¾"! Included power-adaptor even turns your drill into a power Gator! Keep one at home, and one in the glove box. You may just save the day.

■ **The Gator Grip Universal Socket Set, #2384-W $34.95**

From

The Edge Company

TOOLS, GIFTS, & HI-TECH ACTION GEAR

Visit us online at: www.edgeco.com

For Instant Federal Express Delivery, Call Toll-Free

1-800-732-9976

24 Hour Credit Card Order Hotline

Father's Day is June 15!

Free Catalog!

or send check/money order to:

The Edge Company • P.O. Box 826-PS0697 • Brattleboro, VT 05302

Add $6.00 FedEx shipping and insurance per item, $2.00 each additional item.

Every item you buy is backed up by our iron-clad, no-risk guarantee. You will be completely satisfied or your money back.

The Edge Catalog – the hottest gifts, tools, and unique stuff in the world. Now for a limited time, call for a free issue!

Copyrighted material

world of subatomic physics, there exists an antiparticle with the same mass and spin but an opposite charge. So an atom of antihydrogen consists of a negatively charged particle with the same mass as the proton, called the antiproton, orbited by a positively charged particle with the same mass as the electron, called the antielectron.

In the late 1920s, in one of science's most brilliant insights, physicist P.A.M. Dirac actually predicted the existence of antimatter before it had been thought of, much less discovered. In 1932, a graduate student at the California Institute of Technology named Carl D. Anderson found the track of what had to be an electron, but whose direction showed it to have a positive, not a negative, charge. He called it a positron. Not until 23 years later was the next piece of antimatter, the antiproton, discovered using the Bevatron, or particle accelerator, at the University of California, Berkeley. Today, antiparticles are created abundantly in high-energy accelerators. Physicists have even fashioned

THE FACTS

Earthquake!

AS ANYONE who has experienced the phenomenon firsthand will tell you, an earthquake can be terrifying. Only by studying these quakes can scientists and engineers learn to assess the risk from future shocks and reduce our vulnerability to these inevitable natural occurrences.—*C.W.*

Earthquakes are principally caused by the fracturing of rock being stretched or compressed along known geologic fault lines.

The point at which an earthquake originates is called the focus; the point on the earth's surface directly above the quake's point of origin is called the epicenter.

In China in the second century A.D., Zhang Heng invented a seismograph for measuring earthquakes. Dragon figures, each with a ball in its mouth, were arranged around an urn at eight points of the compass. When an earthquake struck, a pendulum inside the urn would swing and knock a ball from the mouth of the dragon into the mouth of a toad figure below. The direction of the earthquake's epicenter could be determined based on which dragon released the ball.

In 1902, an earthquake intensity scale was created by Guiseppe Mercalli based on the amount of damage caused to various structures. The scale was modified by Harry Wood and Rank Neumann in the 1930s and is still in use today.

On a modern seismograph, the magnitude or size of an earthquake's ground waves is measured using the Richter scale, invented in 1935 by American geologist Charles W. Richter. Each higher number represents a tenfold increase in ground motion.

About 90 percent of the world's earthquakes occur in a zone surrounding the Pacific Ocean, known as the Circum-Pacific belt.

The strongest earthquake in the United States struck near Prince William Sound in Alaska on March 27, 1964, killed 131 people, and created a 50-foot wave that traveled 8,445 miles at 450 mph. It measured 8.3 to 8.4 on the Richter scale and is said to have lasted three to four minutes.

The deadliest earthquake killed 830,000 people in the Shaaxi, Shanxi, and Henan provinces in China on February 2, 1556.

The strongest measured earthquake in history occurred in Japan in 1933 and had an estimated intensity of 8.9 on the Richter scale.

Although the 1989 Loma Prieta earthquake lasted only 15 seconds and was centered in a remote section of California's Santa Cruz mountains, it completely destroyed about 60 row houses in San Francisco, collapsed sections of Interstate 880, and damaged a 50-foot section of the Bay Bridge. The quake had a magnitude of 7.1 on the Richter scale.

An estimated 25,000 people were left homeless by the 1994 Northridge earthquake in California. Property damage estimates range from $13 billion to $15 billion.

The probability that another earthquake with a magnitude of greater than 6.7 will strike the San Francisco Bay Area in the next 30 years is 67 percent. The probability in Southern California is 60 percent.

Typically, earthquakes with a magnitude of less than 2.5 on the Richter scale go undetected by humans.

Massive quakes with Richter magnitudes near 8.6 release energy that's roughly equivalent to the detonation of one billion tons of TNT.

The National Earthquake Information Center in Golden, Colorado, locates 12,000 to 14,000 quakes in the United States each year, which translates into roughly 35 each day.

Only about 75 significant quakes occur worldwide each year, however, and many of these (thankfully) occur in remote areas.

atoms of antihydrogen.

What happens when an atom of normal matter and an atom of antimatter meet? They are both annihilated in a shower of gamma rays —proof that the universe must overwhelmingly consist only of normal matter. Why this should be so, why there is no symmetry between matter and antimatter, is one of the great remaining mysteries of science.

What is the purpose of the magnet in a speaker?

Q. Nguyen
mr-2@juno.com

THE MAGNET in a loudspeaker is there to, in effect, give the sound a push. Most speakers use an electromagnet mounted just behind a voice coil, or a cylinder wrapped in wire. Signal current from an amplifier (such as your stereo receiver) flows through the voice coil's wire, creating a magnetic field. That variable field meets up with the constant field from the magnet, pushing the coil back and forth in proportion to the signal strength. That push, in turn, forces the cone or dome attached to the voice coil to move, creating vibrations in the air that we hear as sounds.

This electrodynamic design is by far the most common type of loudspeaker, but it's not the only one. Electrostatic and ribbon speakers use more modern designs, for instance. These moderns designs are not necessarily more efficient or more reliable.

QUESTIONS FOR FYI?

We answer your most frequently asked science and technology questions in the Ask Popular Science section of FYI. Only letters that are selected for publication can be answered.

E-mail: AskPopSci@popsci.com
Address: 2 Park Ave., New York NY 10016
Fax: 212-481-8062

Popular Science

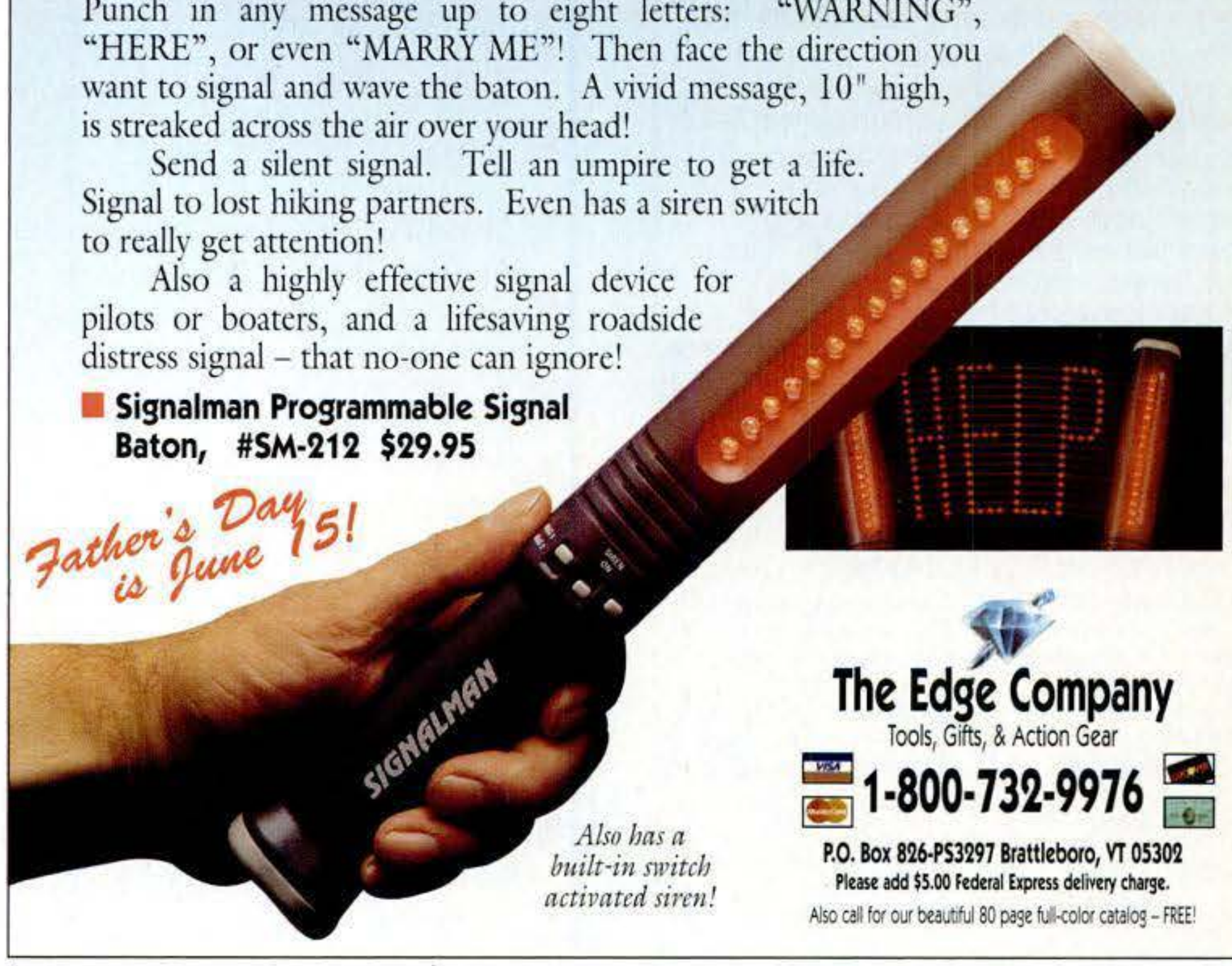
Electronic "Skywriter" Paints Glowing Warnings In The Air.

It works by "persistence of vision" and like nothing on earth. You control the brilliant LED system using the built-in keypad. Punch in any message up to eight letters: "WARNING", "HERE", or even "MARRY ME"! Then face the direction you want to signal and wave the baton. A vivid message, 10" high, is streaked across the air over your head!

Send a silent signal. Tell an umpire to get a life. Signal to lost hiking partners. Even has a siren switch to really get attention!

Also a highly effective signal device for pilots or boaters, and a lifesaving roadside distress signal – that no-one can ignore!

■ **Signalman Programmable Signal Baton, #SM-212 $29.95**



The Edge Company
Tools, Gifts, & Action Gear
1-800-732-9976
P.O. Box 826-PS3297 Brattleboro, VT 05302
Please add $5.00 Federal Express delivery charge.
Also call for our beautiful 80 page full-color catalog – FREE!

Electronic Brake stops the chuck from spinning the moment you release the trigger. No waiting to drill the next hole, drive the next screw or change bits.

- 3/8" Jacobs® Keyless Chuck
- 6 Precision Clutch Settings
- 200 in. lbs. of Torque.
- 0-900 RPM, Variable Speed
- Superb power-to-weight ratio
- Satisfaction Guaranteed

Visit http://www.greattools.com

The 16.8v Cordless SUPER DRILL

Save Big! As part of a nationwide media campaign, the world's largest cordless drill manufacturer has authorized us to introduce their high-powered 16.8v super drill at an unheard of $89.95. Plus, wait till you see the 3 FREE BONUSES you get!

Perfectly balanced T-handle design stands on its own!

More power! Longer running time! Higher torque! Now you can get a fully-loaded *16.8 VOLT* cordless drill for about half of what our competition charges for a 14.4 volt drill.

Why settle for less? This is BY FAR the best cordless drill value available today!

TRY IT RISK-FREE

If this drill doesn't *exceed* your expectations, return it within 30 days for a no-questions-asked refund. To order your 16.8v Cordless Drill/Driver Set with handy carry case, charger and battery, call toll-free, 1-800-925-2005 or send your check for just **$89.95** ($8.95 S&H). Item No. 70-0S4. CA res add sales tax. No dealers please.

Extra batteries are $39.95 ea. ($3.95 S&H). Item No. 75-0S4. Upgrade to a One-Hour Fast Charger for just $12.95. Item No. 21-0S4.

YOU GET 3 FREE BONUSES! If you're among the first 1000 people who take advantage of this exclusive direct-to-you offer, you'll also receive a **300-Piece Drill Kit** containing screwdriver bits, twist drill bits, brad point bits, carbide-tipped masonry bits, drywall anchors and case *PLUS* a **9" Magnetic Torpedo Level** *PLUS* a **21-Piece Bonus Accessory Kit** (a $49.95 combined value)! These bonuses are *yours to keep* – even if you return the drill set. You're guaranteed to come out ahead!

Call Toll-FREE 1-800-925-2005 • Great Tools Direct! 587F Ventu Park Rd. – Dept. 801 Thousand Oaks, CA 91320

I learned my new skills at home.
Now, I'm making $40 an hour."
You can too.

The decision to invest your time, energy and money in training for a new career is one of the most important ones you'll ever make. It can offer you the chance to qualify for the job you want, the money you need, the prestige you deserve and a better life.

Since 1926, Foley-Belsaw has been a world leader in training people for exciting, profitable new careers in high paying fields.

Increase your income in a fast-profit recession-proof career of your own. There's absolutely no obligation and no salesmen will call on you. Just fill in and mail coupon below or call to receive full information and details by return mail.

Mail Today For FREE Fact Kit
Or Call Toll-Free 1-800-487-2100!

FOLEY-BELSAW INSTITUTE
6301 Equitable Rd.
Kansas City, MO 64120-1395
Since 1926

Please Check Only ONE of the Following:

- Locksmithing- 12972
- Small Engine Repair- 52850
- Saw & Tool Sharpening- 21787
- VCR Repair- 62665
- Computer Repair- 64563
- TV/Satellite Dish Repair- 31437
- Gunsmithing- 92470
- Woodworking- 43719
- Upholstery- 81388
- Vinyl Repair- 71320
- Electrician- 95232
- Computer Specialist- 38221
- PC Programming- 35383
- Networking Specialist- 39208

NAME (Please print)
ADDRESS
CITY/STATE/ZIP

MAKE UP TO $26.00 an HOUR
BE YOUR OWN BOSS
START YOUR OWN MONEY MAKING BUSINESS
Hundreds of FOLEY-BELSAW trained men have succeeded in this fascinating and highly profitable field...
You Can Do It Too! ... BE A
LOCKSMITH

Never before have money-making opportunities been so great for qualified Locksmiths. Now lucrative regular lock and key business has multiplied a thousandfold as millions seek more protection against zooming crime. **Yet there's only one Locksmith for every 17,000 people!** Train **FAST** at Home — Collect **CASH PROFITS** Right Away. You're in business ready to earn up to $26.00 an hour a few days after you begin Foley-Belsaw's shortcut training. Take advantage of today's unprecedented opportunities in Locksmithing for year-round **EXTRA INCOME** in spare time — or full time in a high-profit business of your own. Hundreds we've trained have done it. So can YOU! All tools plus professional Key Machine given you with course. These plus practice materials and equipment, plus simple, illustrated lessons, plus expert supervision, plus business-building guidance will enable you to **KEEP THE MONEY COMING IN!** Ideal for retirement — good jobs, too.

FREE BOOKLET
KEYS TO YOUR FUTURE
Tells how you quickly train to be your own boss in a profitable Sparetime or Full-time business of your own.
SEND FOR YOUR COPY TODAY!
30 DAY NO RISK TRIAL
ALL SPECIAL TOOLS AND EQUIPMENT INCLUDED

SEND FOR EXCITING FACTS — NO OBLIGATION!
PRO KEY MACHINE YOURS TO KEEP FREE
This machine can add up to $200 a month to your income... it won't cost you a penny extra with your training.

FOLEY-BELSAW INSTITUTE
6301 EQUITABLE RD., DEPT.12973
KANSAS CITY, MO. 64120
FIND OUT ABOUT IT
RUSH COUPON TODAY

There is NO OBLIGATION ★ NO SALESMAN Will Call - ever!

FREE
KEYS TO YOUR FUTURE
TELLS HOW TO MAKE MONEY IN LOCKSMITHING ALMOST FROM THE START!
FOLEY-BELSAW INSTITUTE
6301 EQUITABLE RD., DEPT.12973
KANSAS CITY, MO. 64120
PLEASE RUSH FREE BOOK *"Keys To Your Future"*
NAME
ADDRESS
CITY-STATE-ZIP

ESSAY

Gigatrends for the Next Half-Century

BY LEVI M. TILLEMANN-DICK

Cowinner, ACM's Vision of the Future Contest for high school students.

IBM HAS JUST announced the invention of the PAN—Personal Area Network—a set of devices that use humans as conductors to relay detailed textual information from one person to another, simply by touch. It is a relatively small conceptual step from the PAN processor that relays a written message through one's body by a shake of the hand to a microcell sensory transmission system that relays ideas and sensations directly to and from the most powerful processor in the world, the human brain.

Within a few decades, PAN-type research will transform the Internet into the LifeNet, a comprehensive sensory environment for human habitation. Our minds will be afforded wireless direct sensory interfacing with other people and various databases. A dramatically enhanced version of what we now call virtual reality will become as common as air conditioning. Telephones, TVs, PCs, and other media will be replaced by wireless sensory feeds from and to communal microcells.

People return to the Internet each day not from addiction, but because they can craft a new identity for themselves—any identity they choose. Or they can participate in experiences that are otherwise beyond their reach. Consider the impact of a technology affording a lifestyle in which you can go wherever you want to go and be whoever you want to be.

Fifty years ago, most workers were farmers or laborers. They were physically strong, ate more, but weighed less. Today's office and service workers have diminished physical capabilities, but are better educated. The LifeNet will accelerate this trend. The need to survive while spending weeks, months, or years on the Net would be drastically reduced.

Resource depletion resulting from overpopulation will cease to be a major issue when we are subsisting on 600 calories a day in a sensory reality where we can eat all we want. Our mansions will be built in our minds, and our future Ferraris will be driven along the roads of our collective imaginations. Our minds will work and play in ways now beyond our conception.

Time constraints dissolve when we can communicate effortlessly anywhere in the world. Humans will require less sleep, since we will need only the time to file and store the information that our brains have collected, and not to rest our physical bodies. The physical body will deteriorate to a state where a return to robust health would take months—if possible at all.

These technologies will be inexpensive. LifeNet participation will consume far fewer resources than an automobile, and reduce our housing and other needs. This will help the LifeNet expand into Third World countries. The equipment required for the microcellular sensory transmission technology will be modular, redundant, and like that for the Internet, incrementally inexpensive. Countries with overcrowding and famine would embrace the LifeNet. Their resources would be extended, and planners would likely program the system to minimize the population's reproductive drive.

People will still have jobs. There will be lots of work to do. People will want to consume the newest experiential sensations. Some food will need to be prepared, and equip-

ment manufactured. Government will be divided into Geographical-Physical and Communicative. The responsibilities of the geographic governments will be to defend land masses and keep order in the physical world—much as they do today. The responsibilities of the communicative governments will be to administer, regulate, and defend cyberspace.

The communicative governments will also be responsible for maintaining the input-output microcells. Various online services are already functioning as a form of communicative government today—with their monthly fees as taxes. As they mature, these communicative governments will develop better defenses against cyberspace terrorism, which may come from large and potentially violent antitechnology cults.

Some people will have to remain physically active and strong, because of the nature of their labor. Tools and equipment will always break down and need repair, and some operations and experiments will require a hands-on approach. Manufacturers, natural resource harvesters, and explorers of all sorts are likely to be visitors to the LifeNet, rather than residents.

Manufacturing will be dramatically reduced, because few people will need cars, clothing, physical tools, or countless other physical objects. Natural resource harvesters will work in every field from farming to mining. Yet as with manufacturing, the need for harvesting will decrease.

Exploration is one of the few physical job categories that is likely to grow, as science expands and becomes more and more complex, and as exploration reaches ever deeper into space and the sea.

Another small group of physical beings would work for various medical and life-support companies. They would have the lives of every individual in the cyberworld in their hands. They would be paid to keep the devices that maintain climates and nourish everyone who has chosen cyberlife. They would have the solemn but necessary responsibility of turning off the machines after an allotted amount of time.

Fifty years from now, reality will consist of some wonderful things, some beautiful things, and some deeply frightening things. ◆

For more information on ACM's Vision of the Future Contest for high school students see Letters, April.

POPULAR SCIENCE SHOWCASE

To advertise in Popular Science Showcase call Diane Pahl at 313-730-9717 today.

We've got you COVERED! ROLL-TOP-COVER™ by PACE EDWARDS

• Padded Leather-Grain Top
• All Aluminum Undercarriage
• Key Lock Security
• Fingertip Access
• Affordably Priced

For the dealer nearest you Call Toll Free!
1-888-ROLL-TOP
2400 Commercial Blvd. • Centralia, WA

CONQUER UNDERGROWTH
with the Amazing Self-Propelled
DR® FIELD and BRUSH MOWER!

CLEARS & MAINTAINS meadows, pastures, woodlots, wooded and rough non-lawn areas with ease. CUTS tall grass, weeds, brambles, tough brush and saplings up to 1" thick. CHOPS/MULCHES most everything it cuts. Leaves NO TANGLE of brush to pick up like hand-held brushcutters and sicklebar mowers.

• 8 HP Briggs & Stratton Engine
• Electric-Starting Optional
• Mows up to 1/2 acre per hour!
• 30 Day RISK FREE Home Trial

©1997 CHP, Inc.

Please call or write for FREE DETAILS!
TOLL FREE 1(800) 652-3344
COUNTRY HOME PRODUCTS®
Dept. 2715F, Meigs Road, P.O. Box 25, Vergennes, VT 05491

2 SEAT BIKE
Drives Like a Car!
Easy to Pedal
Multi Speed
Street Legal
Cargo Carrier
1, 2 & 4 Seater

Free Literature
(615) 822-2737 Ext. 5786
RHOADES CAR

SINGERS! REMOVE VOCALS
Unlimited, Low Cost, Instantly Available Background Music from Original Standard Recordings! Does Everything Karaoke does... Better and gives you the Thompson Vocal Eliminator™
Free Brochure & Demo Tape
LT Sound Dept PS-1
7988 LT Parkway
Lithonia, GA 30058
24 Hour Demo/Info Request Line (770)482-2485 Ext 60
When You Want Something Better Than Karaoke!

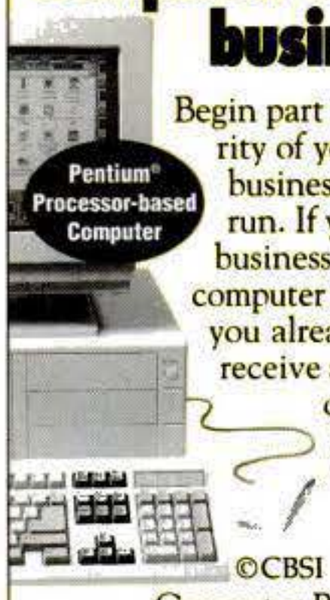
Hand-held ELECTRONIC INSECT CATCHER
U.S. and other country patents/AS SEEN ON T.V.!
Electrify insects instantly!
Kills mosquitoes, flies, cockroaches, ants, spiders, wasps, etc.
CDN $69.95+$9.95 S&H (batteries not included.) 30 day money back guarantee.
Send Check or M/O to: TRIWIN NOVELTIES LTD.
Dept. PS6, P.O. Box 20060, 4839 Leslie St., North York, ON M2J5E4.Canada
To order call: 1-800-391-0122
or fax: 416-498-7604
www.triwin.com

TAN AT HOME!
SUNVISION™ WOLFF® Tanning Beds
HOME DELIVERY • FREE Color Catalog
Buy Direct & Save 1-800-842-1324

FOR SPEEDIER DELIVERY PLEASE USE YOUR ZIP CODE

Copyrighted material

We'll send you this computer to run your own business at home!



Begin part time and still retain the security of your present position. This is a business an individual or couple can run. If you purchase our software and business program, you will receive the computer and printer at no extra cost. If you already own a computer, you may receive a discount. You do not need to own, or know how to run, a computer—we will provide free, home office training.

©CBSI

Call for free cassettes and color literature:

Computer Business Services, Inc.

1-800-343-8014, ext. 5130

Cable TV Descramblers

We'll Beat Any Price!

- **30 Day Money Back Guarantee!**
- **Credit Cards/C.O.D.**
- **One Year Warranty!**

C D Electronics

1-800-684-9135

NO NEW JERSEY SALES!

Anyone implying theft of service will be denied assistance.

---

59 Ways to Help You Qualify for the Job You Want

Free Facts about Career Diplomas and Degrees

Now, at home in your spare time, without any previous experience, you can train for a money-making career...even get a Specialized Associate Degree. Call or send for free information on the career field that interests you most.

CALL TOLL FREE **1-800-595-5505 ext. 1280**

CALL ANYTIME—24 hours a day, 7 days a week.

OR MAIL COUPON TODAY!

http://www.icslearn.com

266ZV

ICS SINCE 1890 **International Correspondence Schools**

Dept. APCS67S, 925 Oak Street, Scranton, PA 18515

Send free facts on how I can study at home for the career I have chosen. No obligation. No salesman will visit. **Check One Box Only!**

ASSOCIATE IN SPECIALIZED BUSINESS DEGREE PROGRAMS

- ☐ 60 Business Management
- ☐ 61 Accounting
- ☐ 81 Bus. Mgmt.—Finance Option
- ☐ 80 Bus. Mgmt.—Marketing Option
- ☐ 64 Applied Computer Science
- ☐ 68 Hospitality Management

ASSOCIATE IN SPECIALIZED TECHNOLOGY DEGREE PROGRAMS

- ☐ 63 Civil Engineering Technology
- ☐ 62 Mechanical Engineering Technology
- ☐ 65 Electrical Engineering Technology
- ☐ 66 Electronics Technology
- ☐ 67 Industrial Engineering Technology

CAREER DIPLOMA PROGRAMS

- ☐ 07 High School
- ☐ 04 Auto Mechanics
- ☐ 52 Surveying & Mapping
- ☐ 85 Drafting
- ☐ 14 Air Conditioning & Refrigeration
- ☐ 22 Wildlife/Forestry Conservation
- ☐ 55 Diesel Mechanics
- ☐ 06 Electrician
- ☐ 70 Small Business Management
- ☐ 25 Gun Repair
- ☐ 02 Electronics
- ☐ 18 Bookkeeping
- ☐ 96 Tax Preparer
- ☐ 03 Child Day Care
- ☐ 23 Medical Office Assistant
- ☐ 24 Dental Assistant
- ☐ 57 Home Health Aide*
- ☐ 43 PC Fundamentals*
- ☐ 27 PC Repair
- ☐ 44 A+ Cert. Test Prep.*
- ☐ 09 Legal Secretary
- ☐ 32 Art
- ☐ 33 Motorcycle Repair
- ☐ 05 Hotel/Restaurant Management

*For personal enrichment

- ☐ 59 Catering/Gourmet Cooking
- ☐ 19 Bartender
- ☐ 38 Personal Computer Specialist
- ☐ 53 Desktop Publishing & Design
- ☐ 48 Computer-Assisted Bookkeeping
- ☐ 94 Fitness & Nutrition
- ☐ 87 TV/VCR Repair
- ☐ 40 Photography
- ☐ 47 Animal Care Specialist
- ☐ 76 Freelance Writer
- ☐ 12 Interior Decorating
- ☐ 30 Florist
- ☐ 26 Teacher Aide
- ☐ 15 Home Inspector
- ☐ 31 Professional Locksmithing
- ☐ 72 Appliance Repair
- ☐ 39 Medical Transcriptionist
- ☐ 79 Electronics Technician
- ☐ 58 Private Investigator
- ☐ 83 Internet Web Page Designer

Computer Programming

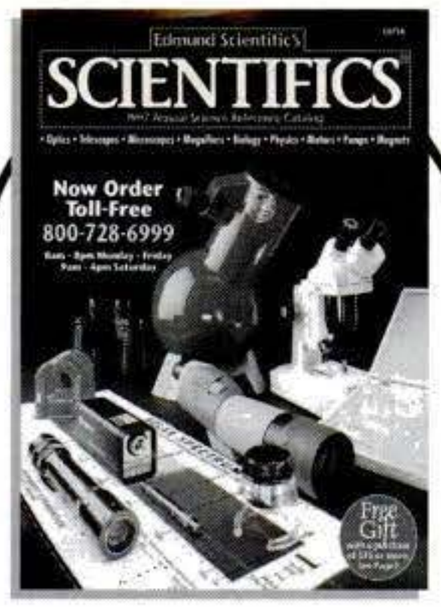
- ☐ 01 QuickBASIC
- ☐ 37 Visual Basic
- ☐ 36 Visual C++
- ☐ 82 Java

Name_____ **Age**_____

Address_____ **Apt. #**_____

City/State_____ **Zip**_____

Phone ( )_____



WHERE SCIENCE COMES ALIVE

- ASTRONOMY
- MAGNIFIERS
- BINOCULARS
- MICROSCOPES
- OPTICS
- PHYSICS
- ROBOTS
- MOTORS
- MAGNETS
- BIOLOGY
- CHEMISTRY
- TELESCOPES

Our famous Astroscan® 2001 extra-wide field telescope provides spectacular images over a wide field of view to any astronomy buff.

Huge selection of laser pointers – ideal for presentations and lecturers.

FREE CATALOG

800-728-6999

or E-mail: A971C911@edsci.com

Visit our new web site at: **www.edsci.com**

Edmund Scientific

CONSUMER SCIENCE DIVISION

Dept. A971, C911 Edscorp Bldg., Barrington, NJ 08007

Phone: 609-547-8880 ■ Fax: 609-547-3292

Revolutionary • Easy to Use

TRIMMER *ON WHEELS!*

The **DR® TRIMMER/MOWER™** rolls *light as a feather*™ on two *BIG WHEELS!*

TRIMS far easier, better, more precisely than hand-held trimmers. **MOWS** everything from whole lawns (even wet!) to tough, waist-high growth with ease!

CALL TOLL FREE 1(800) 652-3344

Even **CUTS BRUSH** and saplings up to 5" thick with optional blade! Far safer than ordinary brushcutters. The easiest to handle trimmer, mower, or brushcutter you've ever used!

Please mail coupon today for **FREE DETAILS** about the Revolutionary **DR® TRIMMER/MOWER™** including prices of Manual and Electric-Starting Models and "Off-Season" Savings now in effect.

Name _____ PSC

Address _____

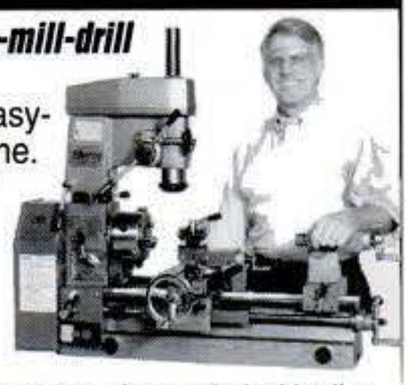
City _____ State _____ ZIP _____

TO: **COUNTRY HOME PRODUCTS®**
Dept. 2715, Meigs Road, P.O. Box 25
Vergennes, Vermont 05491

©1997 CHP, Inc.

OWN A MACHINE SHOP

The Smithy 3-in-1 lathe-mill-drill gives you all 3 basic machine tools in one easy-to-use benchtop machine. Save time, money. For home or business.



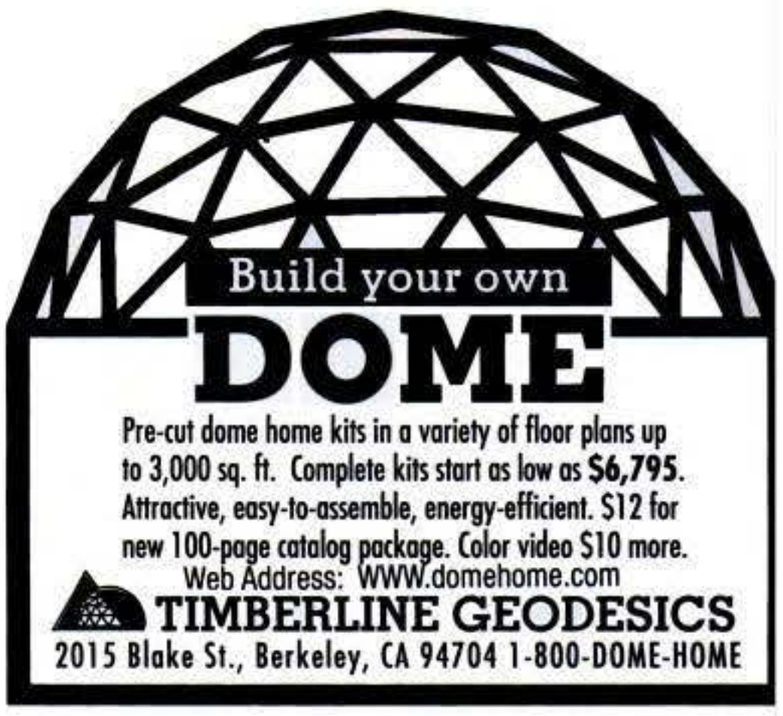
Call for your FREE Info Pak & video.

Backed by service, training, videos, free technical hotline.

FREE Info Pak **1-800-345-6342**

Ask for operator PS6

or write **Smithy** Dept. PS6 PO Box 1517 Ann Arbor, MI 48106-1517



Build your own

DOME

Pre-cut dome home kits in a variety of floor plans up to 3,000 sq. ft. Complete kits start as low as **$6,795.** Attractive, easy-to-assemble, energy-efficient. $12 for new 100-page catalog package. Color video $10 more.

Web Address: WWW.domehome.com

TIMBERLINE GEODESICS

2015 Blake St., Berkeley, CA 94704 1-800-DOME-HOME

Celebrate July 4th & All Events

CARBIDE CANNON

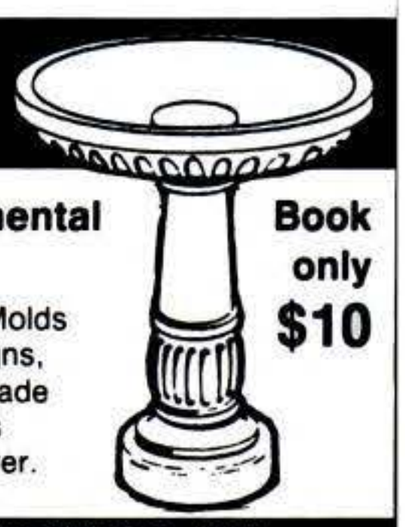
BIG BANG! **$119.95**

Mammoth Cannons shoot with terrific BANG! Have a bang-up time at special events. Uses powdered carbide ammo. Hundreds of shots for few cents. All metal construction with large, rugged cast iron wheels. Machined brass mechanism for easy loading and firing. Authentic turn-of-century design. Handsome decor when not in use. Made in USA to last a lifetime. Available in 3 sizes: 9" cannon, **$49.95 postpaid;** 17" cannon, **$89.95 postpaid;** 25" cannon (shown here) with rapid firing and automatic loading, **$119.95 postpaid.** The larger the cannon the louder the bang! **Carbide ammo, about 100 shots, $6.00; 3-pack $15.00. Spark plugs, 3-pack $2.00.** Send check, money order or call. Visa, MasterCard accepted by mail or phone. Give card number & expiration. Money-back guarantee. Send for **FREE CATALOG!**

The Conestoga Co., Inc., Dept PS, PO Box 405, Bethlehem, PA 18016

★★ Call 1-800-987-BANG ★★

MOLDS



for making Ornamental Concrete Items

Book about Aluminum Molds including over 425 designs, prices and production trade secrets from the world's largest mold manufacturer.

Book only $10

CONCRETE MACHINERY CO., INC.

P.O. Box S99, Hickory, NC 28603

ighted material

GEODOME HOME KITS

• Hurricane Strong • Energy Efficient • Affordable
Precut, prednilled, color coded kits are easy to assemble. 1,100 - 6,500 sq. ft. from $4,500 • Send $15 for beautiful, 150 p. catalog, plans & prices.

GEODOMES WOODWORKS, INC.
BOX 4141, Dept. A-6 RIVERSIDE, CA 92514 (PH 909-787-8800)

Make $25 to $100 per hour

with **Badge-A-Minit**™

Yes, it's really possible by making and selling bright colorful Badge-A-Minit buttons. Buttons are proven money-makers at fairs, flea markets, conventions, or anywhere people congregate. They're fast and easy to make with Badge-A-Minit and inexpensive!

Send for a **FREE** full color catalog or send for a Starter Kit, only $29.95 plus $4.25 shipping. (IL residents add $1.87 tax)

Badge-A-Minit, Dept. PS697, P.O. Box 800, LaSalle, IL 61301
CALL 1-800-223-4103

COME SEE OUR GREAT ADVERTISERS ON THE

PopularScience

WEB PAGE!

http://www.popsci.com

SHOP-TASK
MILL • LATHE • DRILL
P.O. Box 64268, Tacoma, WA 98464

The Original *15th Anniversary*

FREE CATALOG

The Best!

- Technical Support Line
- Spare Parts Line
- 24 Hr. Fax: 206-566-0175
- Videos, Books, Projects

CALL NOW: 1-800-343-5775

YOU CAN DO IT!
MACHINING MADE EASY

WOOD HEAT

Forced air or hot water furnaces

Charmaster®

218/326-6786 2307 C HWY 2 W
GRAND RAPIDS, MN 55744

NEVER SET YOUR TIME AGAIN! with world's most accurate high-tech radio-controlled atomic clock!

Automatically sets accurate time + date + adjusts for start + end of daylight savings time
-Synchronizes time with signal from **US Atomic** Clock, **accurate** to 1 second in 1 **million years**, which times **space flights** and war planes
-**US** and **World Time** + Zone Indicator
-Dual **alarms** + Illumination + month/day calendar
-Lithium memory backup + 2AA bat. included
-Low bat. Indicator + no external antenna
-**Warranted** - Made in Germany - 4.5"x5.2"x2.6"

Enjoy the world's most accurate clock!!!

Accurate – Reliable - Convenient

ORDER TODAY – TOLL FREE 24 HOURS

1-800-985-TIME (8463)

Only $129.95 + S&H $4.95

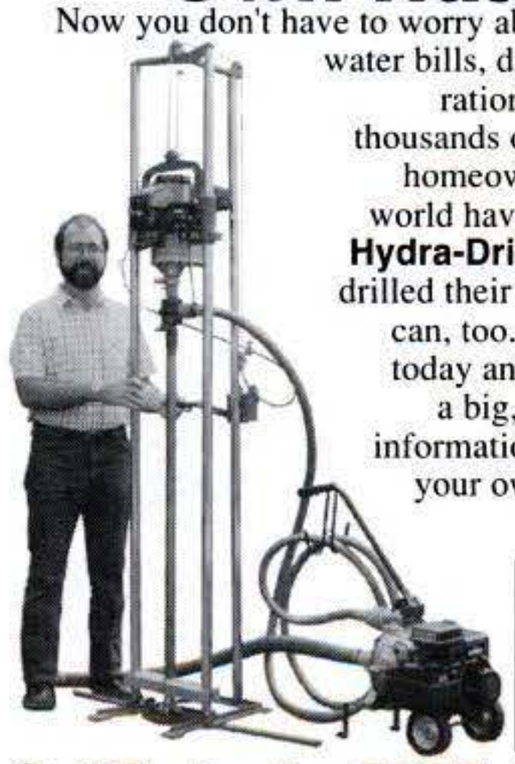
Call or write for free brochures
ZEIT CO., 1010 Jorie #324, Oak Brook, IL 60521
or fax 630-575-0220 or www.arctime.com
Most accurate radio-controlled analog wall clock from $69.95 + shp'g

---

Perfect for In-Ground Sprinkler Systems

FREE INFO!

You Can Drill Your Own Water Well



Now you don't have to worry about tremendous water bills, droughts or water rationing.Since 1962, thousands of gardeners and homeowners around the world have discovered the **Hydra-Drill™** secret. They drilled their own wells! You can, too. Call or write us today and we'll send you a big, free package of information about drilling your own well with the **Hydra-Drill™**.

Ask about our "How To..." video!

Call Today for FREE Water Well Drilling Information Package

1-800-333-7762
(Ask for Operator 7961)

Ph.(334)749-3377 • Fax.(334)749-5601
www.deeprock.com

DeepRock 7961 Anderson Road
Opelika, AL 36802

❑ ***YES!*** Send the **FREE INFORMATION PACKAGE** and the illustrated guide ***HOW TO DRILL YOUR OWN WATER WELL.***

Print Name _____

Address _____

City/State/Zip _____

Phone (must have) _____

© 1997 DeepRock

The Best Value In Spiral Stairs

Buy Factory Direct

- Home Delivery Coast To Coast
- Save 30% to 50% below lumber yard prices
- Quick Ship on Stock Stairs

CALL NOW
FREE BROCHURE
800-368-8280 or 610-631-1360
P.O. Box 183
Eagleville, PA 19408

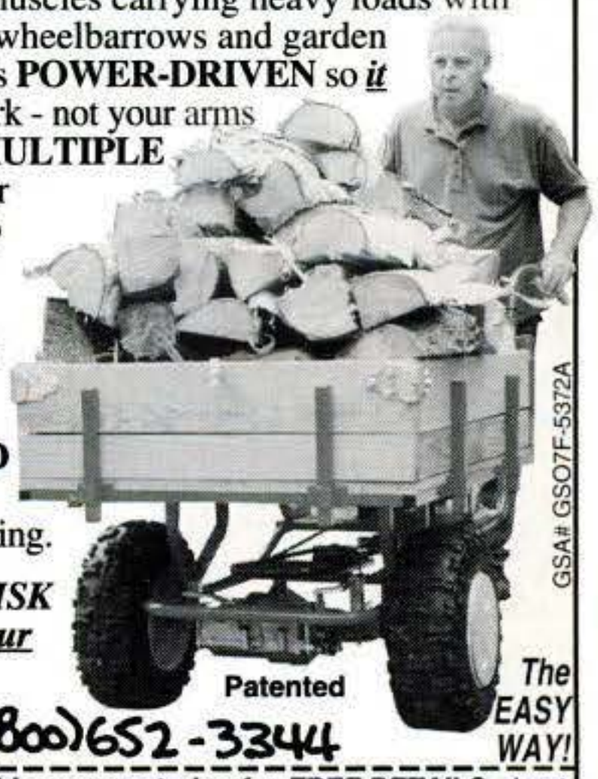
PS697

Salter Industries

WorkSaver... BackSaver!

You too can haul heavy 800 lb. loads with INCREDIBLE EASE with the DR® POWERWAGON™!

The **DR® POWERWAGON™** is great news for homeowners who are tired of straining their backs and muscles carrying heavy loads with inadequate wheelbarrows and garden carts. DR® is **POWER-DRIVEN** so ***it*** does the work - not your arms and back. **MULTIPLE SPEEDS** for powering up hills! **DISC BRAKES** control your speed going down. Easy **DUMP BED** eliminates hand unloading.



So, WHY RISK straining your back?

Patented

The EASY WAY!

CALL 1(800)652-3344

GSA# GSO7F-5372A

Please mail this coupon today for FREE DETAILS about the Revolutionary **DR® POWERWAGON™** including prices and specifications of Manual and Electric-Starting Models, and "Off-Season" Savings now in effect. There is no obligation.

Name _____ PSC

Address _____

City _____ State _____ ZIP _____

To: **COUNTRY HOME PRODUCTS®**, Dept. 2715N
Meigs Road, P.O. Box 25, Vergennes, VT 05491

© 1997 CHP, Inc.

Copyrighted material

To advertise in Popular Science Direct call Liz Irving or Gena Rosenson at 1-800-445-2714 today.

Let us offer you a WORLD of savings..

NEW INTELESTAR

UNIVERSAL CABLE TV CONVERTER & DESCRAMBLER

WE CARRY ALL MAKES AND MODELS

•SCIENTIFIC ATLANTA® •JERROLD® •ZENITH® •PIONEER® •STARGATE® •INTELESTAR®

- Picture Improving Energizer Cables
- Video Stabilizers • Universal Remotes
- Bullet Protectors & Immunizers
- DEALER INQUIRIES WELCOME
- FULL WARRANTY GUARANTEED!!

MEMBER OF THE NATIONAL CONSUMER CABLE ASSOCIATION NCCA

Multi-Vision Cable TV & Video Equipment — FREE CATALOG

Order Toll Free: MasterCard VISA

1-800-835-2330

Order by C.O.D., Check-Via-Phone or VISA / MC

Please have the make and model # of the equipment used in your area.

MULTI-VISION ELECTRONICS INC.

® INTELESTAR, JERROLD, STARGATE, PANASONIC, ZENITH, PIONEER, SCIENTIFIC ATLANTA, TOCOM, & PICTURE-IN-A-PICTURE are all registered trademarks. All references to the above mentioned equipment is for identification purposes only. we are in no way implying that any of the products in our ad original equipment. Multi-Vision Electronics is in no way affiliated with the above mentioned companies or corporations.

NU-TEK ELECTRONICS
Leading the way to excellence

Cable TV Converter-Descramblers

We offer all major brands of cable TV equipment

Infinity 3000

- Factory Installed Descrambler
- 125 Channel Capacity (1-125)
- Sleep Timer
- Advanced Parental Control
- Audio/Video Ports
- Volume Control/Mute
- Favorite Channel Memory

1 Year warranty — 30 Day Money Back Guarantee (less shipping & handling)

NU-TEK offers REPAIR SERVICES for all brands of cable converters & descramblers. Call (512) 250-5031 and press 4 for our technical support department.

Call for your FREE catalog or we are on the Internet at http://www.nutek-usa.com

Open 24 hours

1-800-526-8835 VISA DISCOVER

2 YEAR WARRANTY

Patent Pending — FREE DOOR! — New Easy Bolt Together

INSTANT GARAGES. PROTECT YOUR INVESTMENT!

Only $39 — Easy Roll-Up Door Kit™ Locks Door In Any Position

Protection for Cars, Trucks, Boats, RV's, Motorcycles, Pools, Machinery. Great for Workshops, Paintbooths, Sandblasting, Camp. or Temp. Shelter, Gov'nt & Industrial Contracts, Greenhouses & More. Covers last to 20 years.

- Sizes from 5' to 60'w, up to 30'h, Any Length.
- Heavy Duty Galvanized Steel. Durable Cover & Zipper Door.
- Withstands Ice, Rain, High Winds, Sun, Sap & Heavy Snow!
- Easy Assembly & Anchoring.

SHIPPED TO YOUR DOOR! DEALERS WANTED! 30 DAY MONEY BACK GUARANTEED!

Starting At $199

3' + OF ACCUMULATED SNOW

COVERIT ALL WEATHER SHELTERS

BUY FACTORY DIRECT 1-800-932-9344 Ext. 227

FAX: 203-931-4754 203-931-4777

Get Control of *Unearthly* Monthly Rental Fees

Converters & Descramblers

STOP JAMMIN' ME !

Millennium ENTERPRISES ...It's full of stars

Video Stabilizer Guaranteed to eliminate all copy protection

Free Catalog 1-800-715-6789

ALL MAJOR CREDIT CARDS ACCEPTED

13492 Research Blvd • Suite 120-113 • Austin, TX 78750

CABLE TV CONVERTERS

Save $100's
- All makes and models
- Years of customers complete satisfaction
- Quality Equipment
- Shipped within 24 hrs
- Free catalog

L&L ELECTRONICS INC.

1430 Miner St. Suite 522 Des Plaines, IL 60016

1-800-542-9425

Purchaser must agree to comply with ahh State and Federal laws regarding private ownership of cable TV equipment.

SKELETON KEY

Works With Most Locks

Amaze Your Friends With A Lock Picking Demonstration. You get 3 sized tension keys, the slide pick, precise instructions, & More. Note: this device is to be used for demonstration purposes only!

Satisfaction Guaranteed or Full Refund. 2 weeks delivery. On internet http://www.imall.com/stores/safemarket

Get this exciting device; Send NOW Only $8.95 + $2 S&H to: Safe Marketing Co., 113 N. Washington St. No.366R, Rockville Md 20850

SAWMILL $3795.

FREE INFO

Norwood Inc.
90 Curtwright Dr.
Unit 3
Amherst, NY 14221

1-800-661-7746 Ext. 101

Copyrighted material

CABLE TV DESCRAMBLERS

1-800-844-9588

Compatible With:
*Jerrold, Scientific Atlanta, Zenith Pioneer, Panasonic, and More!
*30 Day Money Back Guarantee!
*1 Year Warranty!
*BEST PRICES IN TOWN !!!
*All Major Credit Cards Accepted!

MONARCH ELECTRONICS

Cable TV Descramblers

Converters * Filters * Accessories

30 day Free Trial - NO RISK!
Unbeatable wholesale prices!
Affordable extended warranty
1 Year Warranty on all products

Free Catalog

Call the cable professionals!

Credit Cards Welcome!
1-800-379-3976
WEB SITE ADDRESS: HTTP://ORION-ELECTRONICS.COM

Orion Electronics — Prices starting as low as $99!

Cable TV Equipment

Save money by owning your equipment and you can still receive all basic and premium scrambled channels through your local cable company. Just call and one of our friendly representatives will assist you in finding the right unit that is compatible with your local cable company. Prices range from $50 to $375.

* All converters and descramblers must be used according to The Federal Cable Television Consumer Protection and Competition Act of 1996.

Phazer Radar/Laser Jammer

Get a ticket, manufacturer pays for it!

Made by Rocky Mountain Radar, this comes with 12-volt accessory jack with plugs, windshield bracket, 3-year warranty, and 1-year ticket rebate.† Think of how many of these babies you could buy for the price of one speeding ticket! Only $199.99! Also available are complete radar/laser detection and jammers. Not available in MN, DC or OK.
†Some restrictions may apply.

Video Clarifier — Copies...

...any video — even those that are copied protected!*

Flawless viewing with state-of-the-art circuitry. Enhances color quality and filters out "snow" and other interference. Includes 12 volt AC power adaptor and switchable channel 3/4 output. Only $59.99.

* For home use only. Not made or sold for unauthorized recording of copyrighted works, including without limitations, unauthorized recording from prerecorded copyrighted movies.

AOC Electronics

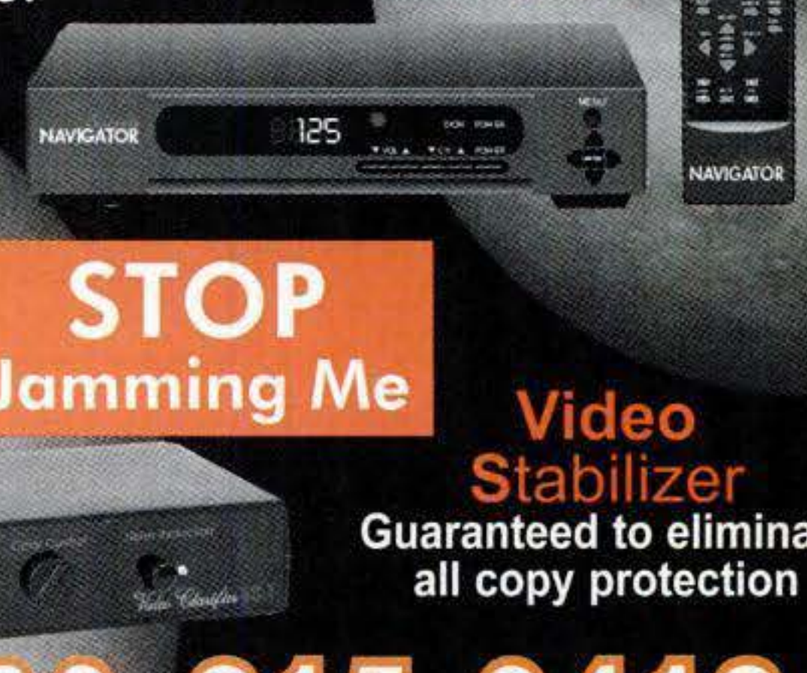
Please call 800-380-4AOC (800-380-4262) for information & a FREE catalog of our fabulous products.

wireless technology • optics • phone systems & accessories • VCRs • audio/visual furniture • radar/laser jammers nightvision • tools • garden & lawn products • security products • auto accessories • consumer electronics • toys

The unit of the Future

Cable TV Converter & Descrambler

Stargate NAVIGATOR



STOP Jamming Me

Video Stabilizer
Guaranteed to eliminate all copy protection

1-800-215-9412

IMAGE ELECTRONICS

FREE CATALOG

We carry all major brands of cable TV equipment

DISCOVER MasterCard VISA

100 E. Whitestone #296 Cedar Park, TX 78613

•STEEL BUILDINGS•

FREE INFORMATION

FREE 16 PAGE COLOR BROCHURE

- Perfect Back-Yard Shop
- 100% Open & Usable Space
- Do-it-Yourself Construction

Save on Select Sizes:
25×36 • 30×48 • 45×82 • 50×120

Now it is easier than ever to own the building of your dreams. Call today to discover how much you can save by ordering **FACTORY DIRECT!**

Ask about our Factory specials and save even more!

FACTORY DIRECT — FROM THE FACTORY TO YOU!

STEELMASTER® PROUDLY MADE IN USA & CANADA

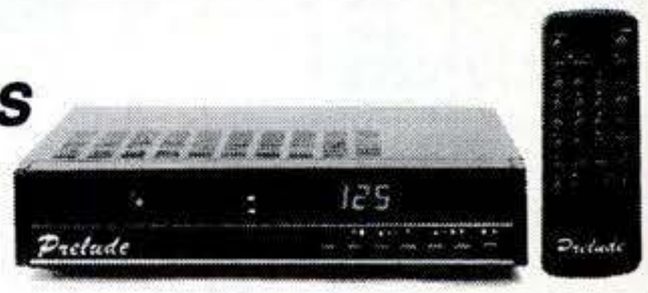
Call Now for FREE Info

1 800 888-4606

(Alaska & Hawaii dial 1-800-527-4044)

CABLE T.V. CONVERTERS & **DESCRAMBLERS**

TKA ELECTRONICS
14937 Industrial Rd. Omaha, NE 68144



13 Month Warranty.
Friendly Service.

FOR A FREE CATALOG OR TO PLACE YOUR ORDER CALL:

1-800-729-1776

SUPERPOOL

NEW!

Just add water and people.

SAVE NOW!

15 YEAR WARRANTY!

RUGGED-PORTABLE-AFFORDABLE

VALUPOOLS

Splash SUPERPOOLS

TOLL FREE (888) 822-POOL
(888) 822-7665

Fax: (602) 503-0961
e Mail: valupool@concentric.net
www.concentric.net/~valupool

CABLE TV DESCRAMBLER

SALE

DEALERS WANTED
EARN EXTRA $$$

9-6 M-F, SAT 10-2
Central Time

FREE Trial
FREE Catalog

We Beat ANY Price !!

CNC Concepts Inc
Box 49503-PS Mpls, MN 55449

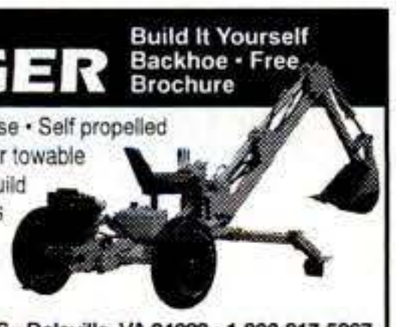
VISA - M/C DISCOVER COD

1-800-535-1843

CAD DIGGER

Build It Yourself Backhoe • Free Brochure

Plans to build and use • Self propelled
- No machining • Car towable
- Under $1,200 to build
- In use over 8 years
- Kit Available



CAD plans

P.O. Box 606, Dept. S • Daleville, VA 24083 • 1-800-817-5267

"TANKLESS" Gas Water Heater

ENERGY SAVINGS
NEVER RUNS OUT!
LP OR NATURAL GAS
COMPACT DESIGN

Call 800/456-3761
For a Free Brochure

NOW On the WEB!

http://www.Plumbingnet.com/myson

Copyrighted material

BUILD A BIKECAR DRIVE ANYWHERE!
1 SEATER - 2 SEATER - PICKUP
BIKECAR! The Amazing Mini Car you Build with Bike Parts. Complete 1 Seater Plans only $12.95. For 2 Seater or Pickup Plans add $5.00 each or order all 3 for only $19.95. To Order Send Check or MO. VISA / MC Orders Call 1-352-854-8324.
Satisfaction Guaranteed or Money Back.
Send To: BIKECAR CORP. PLAN DEPT. P.O. BOX 72 OCALA, FL 34478

Plazac Sales, Inc. 1-800-A-WIRE-4-U 294-7348
JERROLD PANASONIC SA'S ETC CABLE TV CONVERTERS PLUS
•Special Dealer Prices! •Compare our Low Retail Prices! •Guaranteed Prices + Warranties! •Orders shipped immediately! C.O.D.
★ WE'LL BEAT ANY PRICE ★
Sorry no N.J. sales. Dealers Wanted.

ALL CABLE BOXES!
HONEST PRICES
NEWEST DIGITAL EQUIPMENT
Five Star ELECTRONICS
★ ★ ★ ★ ★
1-800-475-2355
No Florida Sales

FREE CATALOG — TEST CHIPS
CABLE T.V. DESCRAMBLERS
Best Prices & Friendliest Service
"Special Dealer Pricing"
Two-Piece Combo $99
(Minimum quantity: 10 lot)
30-Day Free Trial • 1 Year Warranty
GLAMORE ELECTRONICS
1-800-665-1687

CABLE TV CHANNELS
EQUIPMENT *Direct!*
FREE 30 DAY TRIAL
GUARANTEED
SAVE $1000's
The Nationwide source for cable TV equipment.
"BUY WHERE THE DEALERS BUY."
FREE TV Cable Descramblers, Converterters and Magic Box Catalog. Open Every Day!
YOUR VCR TAPES CAN PLAY AS CLEAR AS DAY!
UNJAM NOW WITH Video Decoder
2 Year Warranty
Eliminates copy protection on any tape.
VISA • MC COD
• Copy any rental/bought tape
• Power Cord and RC Plugs Included
Member Better Business Bureau
CALL NOW! FREE 30 Day Trial!
MEGA ELECTRONICS
1-800-676-6342

Sports Chair and Stool

Ideal for all outdoor activities, sporting events, relaxing on the beach...

Model S-2 — $12.95+ $5.95 S&H
Model C-1 — $25.95+ $6.95 S&H
•Available in blue, red and black
•Constructed of heavy-duty steel and nylon
•Opens and folds in seconds

Send check or money order to:
PK Enterprise, Dept. PS-5
4227 Braddock Rd., High Point, NC 27265
FAX: 910-886-1668 Phone: 919-886-1388
Allow 4-6 wks for delivery

CABLE TV EQUIPMENT
Your #1 Source for Descramblers, Converters & Combinations
WE WILL **MATCH OR BEAT** ANY ADVERTISED OR WHOLESALE PRICE!
SAVE $$$ - DON'T RENT
CALL FOR FREE CATALOG!
Zenith, Tocom, Jerrold, Pioneer, Century, Panasonic, Oak Sigma, Scientific Atlanta
CREDIT CARDS ACCEPTED
Call *AA Electronics* Today!
800-258-9512
http:// www.AAElectronics.com

CABLE DIRECT
CONVERTERS · FILTERS
DESCRAMBLERS
COPY RENTAL TAPES WITH OUR VIDEO STABILIZERS
100% MONEY BACK GUARANTEE!
30 DAY FREE TRIAL!
FREE Cable TV Catalog.
VISA MasterCard DISCOVER
SAVE $100'S - EVEN $1000'S on premium CABLE TV EQUIPMENT.
MODERN ELECTRONICS
1-800-906-6664
2125 S. 156TH CIRCLE • OMAHA, NE 68130

Panasonic®
TZPC 145 Converters
only **$59.50**
TZPC 175 Converters with volume control. Please call for pricing.
Great Cable Deals!
FREE 30 day trial period and 1 year warranty
All Other Models Available
We have the BEST DEALER PRICES anywhere!
MasterCard • VISA AMX • COD
YES! WE STILL HAVE THE ORIGINALS!
TvT - 3G, TnT, PIONEER® PIO-3+
By owning, you can still receive all basic and premium scrambled channels through your cable company.
Wholesale dealer prices on Jerrold, Zenith, and Tocom. Please call for information.
Zenith and Panasonic are registered trademarks and all references are for identification purposes only.
MicroCom Industries
Call for your FREE catalog today
800/665-2002
All converters and descramblers must be used according to The Federal Cable Television Consumer Protection and Competition Act of 1996.

Mylen Stairs
Spiral, Straight, and curved Stairs
ALL Sizes & Styles
Steel, Wood, Aluminum
Custom & Stock Kits
Free Brochures & Factory Assistance
1-800-431-2155 ext. PS57
http://www.mylen.com

SPRING SPECIALS!
SIZES: 10×10 thru 100×200
PIONEER STEEL BLDGS
FREE BROCHURE
1-800-813-1358

The *Mini-500*
Financing & Insurance Now Available!
Performance Above and Beyond Your Expectations!
An Affordable, Personal Helicopter • The Choice for a Variety of Private, Utility and Recreational Applications • Low Maintenance and Operating Cost of About $10/Hr. • Patented Control System with the Latest in Advanced Helicopter and Manufacturing Technologies
The World's Hottest Selling Helicopter!
Info Pack & Video Combo: VHS...$30 PAL ...$45
We accept: MC, Visa, AMEX, Discover
REVOLUTION Helicopter Corp.
1905 W. Jesse James Rd. PS • Excelsior Springs, MO 64024
Tel. (816) 637-2800 • Fax (816) 637-7936 • Orders: (800) 637-6867
E-Mail: sales@revolutionhelicopter.com

STAIRWAYS INC.
— ANY SIZE —
STEEL • ALUMINUM • WOOD
BRASS • STAINLESS
Shipped in a Complete Unit or Kit
$425 & Up
Free Brochures
TOLL FREE
(1-800-231-0793)

ALARM SYSTEMS

WIRELESS DRIVEWAY ALARM
A bell rings in your house anytime someone walks or drives into your place.
- Free Literature -
DAKOTA ALERT, INC.
Box 130, ELK POINT, SD 57025
605-356-2772

ALTERNATE ENERGY SAVERS

FREE ENERGY! Fuel-Less Motors and Gener ators! H&A, R2EPS Bowling Green, MO 63334-9350.

HTTP://WWW.ONEKW.CO.NZ/ for **FREE** information on **HOMEMADE BRUS HLESS GENERATORS.**

SAVE UP TO 80% ON HEATING BILLS WITH A YUKON/EAGLE MULTIFUEL FURNACE
Wood/oil, wood/gas, wood/electric whole house indoor warm air furnace.
Eagle Furnace
1000 Ag Science Drive
Palisade, MN 56469
or 1-800-358-0060

INDEPENDENT ELECTRIC SYSTEMS Dis count Catalog $4. WINDPOWER, 13569-PS97 214TH Road, Holton, KS 66436 913-364-4407

NEW! BUILD AMAZING LIQUID PISTON EN GINE from pipe fittings. Free information. ABCO Box 306-S6, Seminary, MS 39479

New **DECLASSIFIED** Free Energy Generators Plans. Energy Research, Box 1514, Jackson CA 95642. Catalog $2.

NEW **FREE ENERGY!** Fuel-Less 350hp En gines. Creative Sciences Box 8001 New Albany IN 47150

APPAREL

SUSPENDER WEARERS! FRUSTRATED WITH CLIPS THAT CONSTANTLY SLIP OFF YOUR PANTS? Our suspenders feature pat ented "no-slip clip." Brochure/ Order (800 700-4515.

AUDIO/VIDEO EQUIPMENT

REPAIR FOAM ROT YOURSELF!
• Save $$$ w/original kit!
• Kits to fit any speaker—Advent, AR, JBL, Bose, Infin., EV, etc.
• Surrounds, adhesive & instr.
• MC/VISA/Discover—no CODs
• Call w/make & model for best price
• Phone 24 hrs. 704-697-9001
or Toll Free **800-747-3692**
Box 1088 • Flat Rock, NC 28731
STEPP AUDIO TECHNOLOGIES

AUTOMOBILES

CARS FOR $100! Trucks, boats, 4-wheelers motorhomes, furniture, electronics, computers etc by FBI, IRS, DEA. Available your area now Call 1-800-513-4343 Ext. S-20025.

SEIZED CARS from $175. Porsches, Cadillacs Chevys, BMW's, Corvettes. Also Jeeps, 4WD's Your Area. Toll Free 1-800-218-9000 Ext A-6586 for current listings.

Copyrighted material

AUTOMOBILES

VAPOR CARBURETOR TRIPLES MPG. Free information. H&A, R2PS Bowling Green, MO 63334-9350.

AVIATION

Airboats. Hovercraft Plans. Propellers, Airdrives, Engines. Catalog $5.00. Arrowprop, 610P, Meeker, OK 74855

Remote Controlled Flying Saucer!
Complete! Ready to Fly! No Assembly! Best Value in RC Hobby
$US 50 + $5 shipping = $US 55 Money Order or Cheque
Check our Web page: http://www.link.ca/saucer
Order from: **Plantraco LTD. 526 Copland Cres. Saskatoon, SK, Canada, S7H 2Z5**
VISA Orders: 24 Hr Voice Orderline: (306) 955-1836
24 Hr Fax: (306) 931-0055
E-mail: ufoman@link.ca
Fly Indoors! Only $50

BACKPACK POWERED PARACHUTES from $4995. **Paraborne** flight training services, too. **www.paraborne.com 1-888-636-9111**

World's safest/simplest aircraft
Parachute-wing, no stall/spin
Uses only two hand controls
Learn to fly in just two hours
Paradise-Flyer™
$5 Info. $20 Info/Video
Check/MC/VISA
Call: (713) 595-FLYR
Tri-gear airframe
Para-Flyer, Inc.
3510 County Rd. 63
Rosharon, TX 77583
No license required

BOOMERANGS! HI -TECH DESIGNS. Amazing Science Project Fun...Returns! FREE Catalog. BoomerangMan, 1806-2 N. 3rd, Monroe, LA 71201-4222.

JET ENGINES. For Homebuilts or enthusiasts. Small, powerful, Mil Surplus. Info $10.00 To: JEI, PO Box 5354, Fargo, ND 58105-5354.

POWERED PARACHUTE NEWSLETTER. Large classified section. $20.00 annual subscription 4 Issues. Portland Powerchutes Inc. 8621 SE Woods Rd. Eagle Creek, Oregon 97022 1-800-457-4310

BUILD and FLY this inexpensive safe, simple, fun aircraft in a week. Takes off from level ground unassisted in a few steps. No licensing required. Fits in car trunk or take it on an airline. Complete detailed informative book with sources for aircraft, kits, parts ... even plans to build your own. Now only! $19.95 at: **EASYUP** 1089 Medford center #244sd Medford OR 97504 USA. Check us on the Web at http://www.wave.net/easyup/

Jet Power Up to 37 lbs. of thrust!!
BUILD THIS AMAZING JET ENGINE IN YOUR OWN HOME SHOP!
Jet power for • 1-PERSON HELICOPTERS • AIRPLANES • JET PACKS • GO-KARTS • BIKES • ROCKETRY
YES! We sell kits & jets! Info sent with your order.
Complete Pulsejet Plans
ONLY $22.95
plus $3 p/h — $6 foreign
SUPER BONUS FREE WITH YOUR ORDER! How to Build a Jet Helicopter! A $15.00 Value
Order from: **Windspire**
PO Box 145 • Dept S
Long Green, MD 21092
For credit card orders: (410)836-6824

AVIATION

BUILD AND FLY THESE AMAZING AEROSPACE MODELS
ADVANCED TECHNOLOGY CAN BE BUILT TO ANY SIZE
Airship Plans- $39.95 | Flying Saucer Plans-$49.95 | Starship Plans- $69.95
Info Pack $10.00 • Aerospace Experimenter's Handbook $16.95 S+H add $10.00. Complete Construction Plans: each "Plans" order includes an Experimenter's Handbook FREE. Order from: **Tech 3000, Box 68006-471 River Ave., Winnipeg MB R2L 2V9 http://www.tech3000.com**

BEER/WINEMAKING

BEERMAKERS Winemakers Free Catalog. Fast Service, Free Recipes. Cellar-S, Box 33525, Seattle, WA 98133. 800-342-1871 E-mail homebrew@aa.net

FREE CATALOG. Brew Quality Beer Yourself Easily. Call WindRiver Brewing: 1-800-266-4677 Anytime.

Homebrewers, FREE CATALOG. Great Beginner kits. Brewery, Box 14712PS, Minneapolis, MN 55413. 800-234-0685.

http://www.brewguys.com Homebrewing Suppliers: On-line. Recipes, New Products, Brew Help Live - Thursdays, **1-888-BREW-GUYS... FREE CATALOG.**

WINEMAKERS - BEERMAKERS. Free Illustrated Catalog. Since 1967. 1-800-841-7404. KRAUS, Box 7850-N, Independence, MO 64054.

BETTER HEALTH

END HAIR LOSS! STOP MAKING IT WORSE. SEND $4.95 TO: ICAIP, PO BOX 6057, LONGMEADOW, MA 01116-0571.

LIVE LONGER! Report tells secret of slowing down your body's aging process. Send $4. Park Lane Trading, 13835, Pasco Cevera, San Diego, CA 92129

Proper diet + exercise= Feel Better! Program, $5.00. H.Shaffer, 12101 Indiana #31, Riverside, CA 92503

VITAMIN POWER. Nutritional Supplements. **FREE** Catalog- Vitapower, 65 Myrtle Ave., Dover, NJ 07801

Waterwise Purifiers... homemade distilled. (800) 874-9028. Box 45981, Center Hill, FL 33514-0459

BOATS & EQUIPMENT

BOAT KITS -- PLANS -- PATTERNS -- EPOXY -- FIBERGLASS -- SUPPLIES -- All Types, All Sizes. **HUGE CATALOG -- $3.00.** ($5.00 Priority) -- BOOK "Boatbuilding" -- $6.00. **CLARK-CRAFT,** 16-7 Aqualane, Tonawanda, NY 14150. **(716)873-2640.**

BOAT PLANS- PATTERNS- KITS- 176 page **CATALOG- $5.00. GLEN-L**, Box 1804/PS7, 9152 Rosecrans, Bellflower, CA 90707-1804. 562-630-6258.

BOOKS/PUBLICATIONS

ACCOMPLISH ANYTHING YOU WANT IN LIFE. Send $10.00 to: Brenco Rt.3 Box 302 McKenzie, TN 38201

BUILD A WORKING ROBOT with this new book that includes everything you need to build a working Stiquito robot. Only $35.00. Call the IEEE at 800-701-4333 to order or for more details.

Businesses... Tired of searching for dozens of formulas on pricing, wages, takes, and more? Send $22.95 for easy to use booklet. Timesaving Wonders, P.O. Box 309-P, Williamston, MI 48895-0309.

CONSEQUENTIALISM says sentient continuum subtly cultivate mankind to develop technology, conquer the universe. For $1 manifesto, SASE, 1671 Ft. Campbell, #W3, Clarksville, TN 37042

Warning! A Lawsuit Could Bankrupt You. Be judgement proof. Free Report. (615)664-1753

BOOKS/PUBLICATIONS

LEARN CRAPS! BOOK EXPLAINS EASIEST AND MOST COMPLETE WAY TO PLAY. 1-800-974-7761.

Probably, the most important information you need to know. Send $7 to receive the;'Pentagon Papers IV'. P.O. Box 151722 Austin, TX 78715-1722.

PUBLISH YOUR BOOK! Free guidebook to subsidy book publishing. Vantage Press, Dept. AP, 516 West 34th Street, New York, NY 10001.

BUSINESS OPPORTUNITIES

$1,000 weekly stuffing envelopes. Receive $2.00 each. Rush stamped addressed envelope. Colossal Box 040215-PS, Brooklyn, NY 11204.

$1,500/ THOUSAND Immediately. Stuffing Envelopes. Free Supplies. Send S.A.S.E.: J.H. Enterprises, Dept. PS6, 114-1027 Davie Street, Vancouver, B.C. V6E 4L2.

$1800 WEEKLY RECORDING VIDEOTAPES At Home. No Copyright Violation. Free Startup Information. CMS Video, 210 Lorna Square, #163BSF, Birmingham, AL 35216

#1 MONEY MAKER Spare Time! No selling! No inventory! Publicly documented seven week $19,919 income! Free audio cassette and Report reveal everything. Real Money, 333-PS67, SW 5th Street, Grants Pass, OR 97526.

$2,000 DAILY From your Telephone Answering Machine! I've made over $1,000,000 using mine! (303) 637-1492. Recorded Details.

$2000 weekly!... Assemble products at home. Free infopak!... Universal-PS, 1454 Rockaway Parkway, #249, Brooklyn, NY 11236

$2,136,000 IN 6 MONTHS working only 20 minutes daily! Toll-Free recorded details: 1-800-657-3378 or (303)654-7115.

$3,000,000 In 2 Months Using All Free ads. Recorded Details: 1-(416)255-5058 BT.

REPAIR CRACKED WINDSHIELDS
Earn $90,000 Yearly Repairing
-not replacing-
Large Cracks in Windshields
CALL 1-800-826-8523
or write The Glass Mechanix Inc.
4555 NW 103rd Ave. • Ft. Lauderdale, FL 33351

$40,000 ON 1/3 ACRE! New hydroponics - inexpensive, practical! Planter's, Box 681804, Franklin, TN 37068-1804. http://www.mayhillpress.com

$50 HOUR RECOVERING FREON. Free details. Nova, Dept. PS6, Box 139, Cerro Gordo, IL 61818

AMERICA'S greatest environmental concerns have become the business opportunity of the 90's!! Details 1-888- 422-2288.

CAREER BURNOUT? HOME HEALTH BUSINESS, SERIOUS INCOME, NO REJECTION, FREE INFORMATION 1-800-353-3312.

FAMOUS MAILORDER MILLIONAIRE reveals money-making secrets! Free exciting cassette. Melvyn Powers, 12015 Sherman Rd., North Hollywood, CA 91605.
http://www.mpowers.com

FINANCIAL INDEPENDENCE, HOME-BUSINESS, EASY: Whitman Products, Box 211, Sharpes, FL 32959-0211.

FREE! Turn any Computer into a **Money Machine. Free** Report: 1-800-221-3813 OperPS101

GET PAID $268.20/ Roll Taking Easy Snapshots! Film Supplied. Phototek, Box 3706-PS, Idyllwild, CA 92549. 909-659-9757

If you're not earning $100,000 plus per year, call 1-800-678-5522, ext. 347.

BUSINESS OPPORTUNITIES

GREAT BUSINESS OPPORTUNITY. Earning potential of $10,700/ day. SIMPLE. Free information 1-888-872-0384.

HIGH- TECH ENGRAVING Can Make You Up To $30 to $95 an hour! 24 hr. message, call 1-800-322-6169, Ext# 2708

HUGE PROFITS. $IMPLE HOME BUSINESS. Send $1.00. F.O.M., 2110 Route 70 East, Suite 118, Cherry Hill, NJ 08003.

HYDRAULIC JACK REPAIR MANUAL AND CATALOG $10.00. HYDRAULIC PARTS SUPPLY, BOX 4157, BROWNSVILLE, TX 78523-4157.

INCREDIBLE MONEYMAKING OPPORTUNITIES!!! Become financially independent **FAST** through, Auctions, Foreclosures, Grants. **1-800-728-0953.**

EARN $60,000 YEARLY
Repairing (not replacing) stone damaged windshields and plate glass. Learn how a 3 minute repair can earn you $1200/week!
CALL NOW! 1-800-695-6224
FREE REPORT!
NVS/OPTIKLEER, LYNN, MASS. 01904

JOIN HOME-WORKER'S ASSOCIATION -- Get "Guaranteed Legitimate" home-employment offers! (Many Choices!) Write: Association-PS697, Alexandria Bay, New York 13607-0250

MAKE $15,000 monthly! The Perfect Business. No investment. Easy. Free Booklet. MPC, Box 57, Lenore, ID 83541.

MAKE $25.00 / POUND From Free Aluminum Scrap? YES! Free Report! Ameriscrap- PS697, Alexandria Bay, New York 13607-0127

MAKE A FORTUNE IN MLM Free Report shows you how. Call now! 1-800-656-6397 ext.363. www.prostepinc.com

Make Thousand$ Doing What You Love.. Rehabbing. Handy information workbook shows you how. Send $4.00 to Clarion, 517 SE 2nd, Suite E-6PS, Lee's Summit, MO 64063. Satisfaction Guaranteed!

MILLIONAIRE'S SECRET IS OUT! Learn what they didn't tell you. Free information. CNW-PS, 13558 Lourdes Street, New Orleans, LA 70129

MILLION DOLLAR HOME BUSINESS! IDEAL FOR MAIL ORDER. WE SUPPLY EVERYTHING. WE DROP-SHIP 3,500 BEST SELLING PRODUCTS, PRICED FAR BELOW WHOLESALE. IMMEDIATE DELIVERY. FREE BOOK, TAPE. SMC, 9401 DeSOTO AVENUE, DEPT. 28-102, CHATSWORTH, CA 91311

MONEY MAKING MACHINE. Curbmate machine installs beautiful concrete lawn edging. Amazing profits. 801-262-7509.

$$$ EARTHWORM & LOBSTER GROWERS WANTED! $$$
MAKE HUGE PROFITS raising Giant California Superworms or Australian Lobsters for worlds largest earthworm distributor for over 60 years. Superworms convert garbage into rich organic fertilizer. Easy to raise and fast multipliers. Grow them in your own backyard, garage, or farm. Distributorships and Joint Venture Partnerships available. Call now for more exciting information on this unbelievable money making opportunity.
SUPERWORM
PHONE (818) 363-0202 FAX (818) 360-8562
Web Site: http://www.superworm.com

Nationwide Distributors Needed. Patented Hot product of 1997. (201)252-0999 TC, 1051 Stuyvesant Avenue, Suite 251, Union, NJ 07083

NEW! GROW EXPENSIVE PLANTS, 2000% PROFIT. Free information. GROWBIZ, Box 306-S6. Seminary, MS 39479.

PIANO TUNING PAYS: Learn with approved home study course, Diploma granted. American Tuning School, 17050 Telfer Dr., Morgan Hill, CA 95037.

Copyrighted material

BUSINESS OPPORTUNITIES

PROFIT IN POWER WASHING. $40 - $60 hourly. Free report (full publication $14.95 + 3.00 S&H): CSP, PO Box 20590, Columbus OH 43220.http://www.carvedstone.com/

Reclaim "Scrap Gold" From Old Computers/ Jewelry. Free Information. 24 Hours: (603)645-4776.

STAY HOME! PROCESS MAIL! PAY WEEKLY! GUARANTEED! DETAILS: RUSH LONG S.A.S.E.: MARKETING/PS, MAPLE GLEN, PA 19002-8009.

THE INFORMER, entrepreneur's newsletter, **REVEALS & REVIEWS** advertised "Get Rich" system secrets! Recorded details: 213/461-0380

YOU STRUCK A GOLD MINE. Earn $60,000 a year Gold/Chrome Plating Emblems Or Automobiles. Free Information, Call US/Canada: 1-800-877-0066. Write: The Gold Mine, 5405 N.W. 102nd Avenue, Suite 221, Ft. Lauderdale, FL 33351

BUY IT WHOLESALE

39,457 Products, Factory Direct... **TAIWAN, HKONG, MEXICO!!** Save 500-900%... Echo, Box 739-C67, Shalimar, FL 32579-0739.

FAMOUS NAME REPLICA WATCHES. Amazing Re-creations. Excellent Quality. Free Wholesale Brochure. 1-800-553-4334.

FREE 600,000 ITEMS, Wholesale Directory (LSASE) TNT, Box 2614P, Big River, CA 92242

POLO SHIRTS EMBROIDED AS LOW AS 9.00. JACKETS 35.00 embroided. COFFEE MUGS 22K GOLD IMPRINT 85¢ ea. **JODIME MAIL ORDER,** P.O. BOX 8123 RIVERSIDE, CA 92515-8123.

CABLE EQUIPMENT

$99.00 BLOWOUT. All Boss 2 Piece. Zenith, Tocom, Jerrold. 5 Lot. Visa/ Mastercard. 1-800-219-8618.

Alert! **CABLE DESCRAMBLER KIT.** Only $7.50 if you mention this magazine with your order... THAT'S HALF OFF! 1-800-752-1389.

ALL CHIPS $9.00 -$18.00 & CONVERTERS. QUANTITY DISCOUNTS. NO MINIUM. ANYTIME. 1-880-760-0555.

ATTENTION DEALERS! **SPECIAL INTRODUCTORY OFFER** on all cable TV equipment! Buy **WHOLESALE** and **SAVE** 100's. 1-800-884-3473.

BIG SALE!! Notch Filters $18.00. E-Z install test **activation chips/ boards from $5.00.** Bullet/ ID Stoppers $9.95. **Name brand descramblers from $139.** External activators from $65. **DEALERS WELCOME. LET US BEAT YOUR BEST PRICE. 1-800-449-9189 ANYTIME.**

CABLE BOXES AND ALL ACCESSORIES. BEST PRICES, DEALERS WELCOME. FBN ELECTRONICS, 1-800-225-9756

CABLE BULLET "TERMINATOR/ I.D. BUSTER." Electronically shields yourself and your box. **LIFETIME GUARANTEE. Wholesale prices. 1-800-820-9024.**

RFT/TMG
$60.00
*** 30 Day Trial * 1 Year Warranty ***
(314) 569-4027
WORKS ON ALL JERROLD SYSTEMS
E-Mail: cbi5694027@aol.com

CABLE CONVERTERS, TEST MODULES. Money-Back Guarantee. **EXTREMELY COMPETITIVE.** New Custom 2200 Modules. Catalog, Credit Cards. 888-443-9185

CABLE EQUIPMENT

CABLE CONVERTERS, Test Chips. Money-Back Guarantee. 1 Year Warranty. JCB ELECTRONICS, **1-800-579-3285.**

Cable Descramblers and Turn-on Chips. Pioneer; Jerrold; Tocom; Zenith; Scientific Atlanta. Hudson Tech Inc: 1-800-577-5617

CABLE DESCRAMBLERS/ CONVERTERS. REPLACEMENTS FOR ALL MAJOR BRANDS. **BEST PRICES!** MONEYBACK GUARANTEE! FREE CATALOG! **ALLSTAR 1-800-782-7214**

CABLE DESCRAMBLER!! ANYONE CAN BUILD in **SEVEN STEPS** with **RADIO SHACK PARTS. PLANS/KIT** from **$5.00** plus **FREE BONUS!! 1-800-818-9103.**

CABLE DESCRAMBLERS. The Best In Converters and Descramblers. Prompt Delivery, Best Prices Anywhere In The USA. (702)895-9120

CABLE TV EQUIPMENT
CONVERTERS/DESCRAMBLERS
FILTERS-BULLET PROTECTORS
SAVE 1000'S - 30 DAY FREE TRIAL
CUT THE HIGH COST OF CABLE TO FRIENDS, RELATIVES AND NEIGHBORS. MAKE $$$$
CALL QUALITY TIME
1-800-205-5165

CABLE/ SATELLITE DESCRAMBLING. New digital satellite fix. Voice/ FAX 716-283-6910. http://www.scramblingnews.com

CABLE-TEST CHIPS As low as $9.95 For Testing Cable Boxes in Full Service Mode. F.T.G.'S; CUBES; JERROLD; PIONEER; TOCOM; SCIENTIFIC ATLANTA; ZENITH; REMOTES $10; Lifetime Warranty. Full Technical Support. MC/VISA/COD. **NORTH TECH INCORPORATED.** 800-926-4030

CABLE T.V. CONVERTERS AND DESCRAMBLERS. WHY RENT? CALL BASIC ELECTRICAL SUPPLY. 1-800-577-8775

CABLE TV DESCRAMBLERS. ALL MAKES. IMMEDIATE SHIPPING. VISA/ MC/ COD. WING WHOLESALE 800-304-4408.

TURN ON CHIPS
LOWEST PRICES
1-800-639-5542
NO FL. SALES

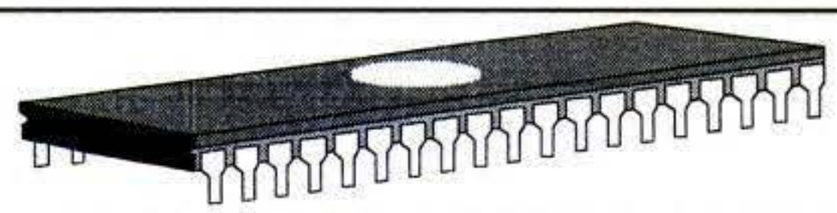
CABLE TV DESCRAMBLERS/ CONVERTERS. BARGAIN HEADQUARTERS. MAKE YOUR BEST DEAL WITH US. **GATEWAY ELECTRONIXS,** 1-800-422-2533.

CABLE TV, DESCRAMBLERS, CONVERTERS, QUANTITY DISCOUNTS, 30 DAY MONEY BACK GUARANTEE. NO CATALOGS. COMPETITIVE PRICES. CALL NOW: 1-800-322-0921. REGAL SALES INC.

CABLE TV DESCRAMBLERS. CLIFFORD ELECTRONICS. CALL NOW TOLL FREE: 888-298-0200.

CLEAR IMAGE HIGH- TECH VIDEO CLARIFIER. Removes all Video Copy Protection. 1-800-495-6888.

CABLE EQUIPMENT



CABLE CONVERTER DIAGNOSTIC TEST CHIP
LOADS FULL ACTIVATION OF CABLE CONVERTER
WE STOCK A COMPLETE LINE OF CHIPS,TOOLS, WIRELESS QUICK INSTALL TEST BOARDS AND DIAGNOSTIC CUBES. WHOLESALE PRICING-DEALERS WANTED.
***** ANYONE IMPLYING ILLEGAL USE WILL BE DENIED SALE. WE SELL PRODUCT *** ONLY!!! TO QUALIFIED BENCH TECHNICIANS OR CABLE REPAIR FACILITIES!!!**
***LOWEST PRICE & SUPERIOR PRODUCT GUAR, BUY 5 TEST BOARDS & GET 1 FREE**
MON -FRI- 8AM-7PM - SAT 10M-2PM-EST. HTTP://WWW.800-GOCABLE.COM
VISUAL COMMUNICATIONS INC.
FOR CATALOG & ORDERS 1-800-GO-CABLE ESTABLISHED 1976
TECHNICAL SERVICE DEPT. 717-620-4363 SORRY NO PA SALES

CABLE TV EQUIPMENT & ACCESSORIES Wholesalers Welcome! 30 Day Moneyback Guarantee! Free Catalog! **PROFORMANCE ELECTRONICS, INC. 1-800-815-1512.**

CABLE DESCRAMBLERS & TEST CHIPS. All models... lowest prices. Available overnight. Chipsmart, 1-800-208-2638/ TECH. 954-792-7012

THE CABLE STORE
Cable TV Converters & Descramblers
ABSOLUTELY THE LOWEST PRICES
NOBODY BEAT US!
All Brands * Money-Back Guarantee
1-800-390-1899

CD ELECTRONICS IS NOW SELLING CONVERTERS/ DESCRAMBLERS DIRECT AT WHOLESALE PRICES. 30 DAY TRIAL. QUANTITY DISCOUNTS. 1-800-842-9670.

DESCRAMBLERS... CONFUSED? We'll Explain All Your Options. All Models Available. Quality Service. Open 6 days, Mon-Sat 9:00a.m.-8:00p.m. **SUNSTATE ENGINEERING 1-800-717-1575**

DESCRAMBLE CABLE WITH SIMPLE CIRCUIT. EASY TO BUILD. COMPLETE UNIVERSAL KIT WITH FREE BULLET BLOCKER. $20.00. 1-800-522-8053.

FREE Big Dish Catalog- Low Prices- Systems, Upgrades, Parts... and **"4DTV"** Skyvision, 1030 Frontier Dr., Fergus Falls, MN 56537. 800-500-9264. International 218-739-5231. www.skyvision.com

FREE CATALOG- NEW TECHNOLOGY BREAKTHROUGH- T.V. CONVERTERS DESCRAMBLERS SAVE $1000's. CALL NOW. MEGA 1-800-676-6342

PUZZLED ABOUT **DESCRAMBLERS**? WE'LL EXPLAIN ALL YOUR OPTIONS. WHOLESALE/ RETAIL. OPEN 6DAYS. BEST TECH SUPPORT &FRIENDLY SERVICE. TOLL FREE **1-888-238-0967.** ROYAL ENGINEERING INC.

RSP AND ASSOC. SUPER BLOWOUT CHIPS SALE!! ALL CHIPS $11.00- $18.00. NO MIN. NO CA. 1-510-278-3615.

****SHH... BEST KEPT SECRET-** INCREDIBLE Wholesale Prices on Descramblers. BUYER'S ASSOCIATES, 1-800-889-5139.

TEST CHIPS, GUARANTEED QUALITY. $30-$40. TECHNICAL SUPPORT, QUANTITY DISCOUNTS. TELECHIP, 1-800-793-7567.

CABLE CONVERTERS/DESCRAMBLERS
*****SUPER BUYS*****
*** Full 2 Year Warranty***
* Tocom™ * Jerrold™ * Scientific Atlanta™ * Pioneer™
"WE SERVICE PRIVATELY OWNED CABLE CONVERTERS"
SALES: (219) 935-4128, TECH: (219) 935-4130
Sorry, no IN, NY, NJ or MI Sales
NATIONAL CABLE BROKERS
1801 W. Jefferson St., Plymouth, IN 46563

SECRET CABLE DESCRAMBLERS! Buil your own Descrambler for **LESS** than $12.0 in **SEVEN EASY STEPS! RADIO SHAC** Parts List and **FREE** Descrambling Methoc that **COST NOTHING** To Try, Included. **BO NUS!** Outrageous Report showing how peopl steal electricity without getting caught. Sen $10.00 to: **INFORMATION FACTORY,** P.C Box 669, Seabrook, Texas 77586. For VISA MC, C.O.D's, 1-281-922-3512 Any Time!

TECH SUPPORT ELECTRONIC 1-888-273-1349. Basic cable TV converter personal security equipment. Money- back gua Free catalog.

CABLE T.V.
Converters & Equipment
WISE PRODUCTS
30-day money back
1-year warranty
Dealers Welcome!
1-(800) 434-2269
Visa, MC, Amex, COD

"The Ultimate Cube!" External Test Activa tors, for all brands, works everywhere (718)768-4963.

Wholesale Unmodified SLOT. Tocom VIP $60 Zenith, 5503A, Oak. Jerrold DRZP $22, DP $50. Visa 1-800- 500-9825.

SPECIAL OFFER
PANASONIC CONVERTER and SEEMORE DESCRAMBLER
$99.00
(min. order 10pc)
800-839-8491
NO FL. SALES
SOUTHERN ELECTRONICS

CALL 1-800-445-2714 for Advertising Info!

Copyrighted material

CABLE EQUIPMENT

New Products
works on all systems
Wholesale pricing-Dealers wanted
800-763-7277

CABLE TV BOXES
$AVE RENT
JERROLD ZENITH TOCOM OAK SIGMA
Get the Clear Picture
HAMLINE PIONEER SCIENTIFIC ATLANTA
FACTORY DIRECT · FREE 30 DAY TRIAL · FRIENDLY SERVICE
VISA - MC - COD
1-800-833-1606
MICHAEL'S ELECTRONICS
DESCRAMBLERS

CABLE TV DESCRAMBLERS
* Your Descrambler Connection *
Free 1 Year Warranty • Free 30 Day Trial
Equipment Set Up Tech Line
PC ELECTRONICS
(800) 675-7125

CATALOGS

Catalog List. Hunting, Outdoor, Survival, Pets, Misc. Gifts. Thousands of Items, Over Fifty Catalogs. Send $2.00 to: Two Bills, 30 W. 360, Rt.19, Elgin, IL 60120

ADVANCED SCIENCES
"25th Century Technology Today"
Time Travel - Invisibility - Levitation - Radionics - Mind Power Devices - Hidden Technology - Courses - Hundreds of Products !!! Catalogue $4.00
P.O. Box 2917-P, Palm Springs, CA 92263
Phone (619) 327-7355, Vs,Mc,Amex

COMPUTERS/SOFTWARE

AMAZING NEW BOOK! Save over $1,000 on your next computer! **FREE** information. 1-888-822-1750 ext. 697

CONTACT LENSES

CONTACT LENSES. Absolute lowest prices on your contact lenses. Guaranteed. Call **1-800-CONTACTS.**

DO-IT-YOURSELF

Bill WAGNER Painting Products. Discount Pricing. 929T Power Roller, $39.95. 305T Produty Airless, $59.95. (888)288-6761.

BUGGED? PHONE TAPPED? FREE Catalog of Counter-Surveillance Equipment tells you fast! (800) 732-5000

GSM Microbug Transmitter: U.S.$15.00. Globalec, Apartdado 105, 4970, Arcos de Valdevez, Portugal.

SURVEILLANCE
Ultra-Miniature Pinhole Camera w/audio $159.00 • Hidden Video • Wireless Video • Electronic Kits • Shotgun Mics • Vehicle Tracking • Voice Changers • Bug / Phone Tap Detectors • 7 & 16 Hour Telephone Recording Systems • Locksmithing • And Much More!!!
Wholesale / Retail
FOR CATALOG SEND $ 5.00 TO:
SPY OUTLET
POBox 337, Buffalo NY 14226 (716) 691-3476

DO-IT-YOURSELF

ELECTRICAL -EASY FOLLOWING DIAGRAMS FOR HOUSEHOLD PROJECTS. ALL YOU NEED TO KNOW, $17.00. J&J INSTRUCTIONALS, BOX 140434, HOWARD BEACH, NY 11414-0434

DON'T THROW AWAY THAT USED COPIER OR PRINTER CARTRIDGE!
Do it yourself it's easy
REFILL IT SAVE OVER 75%
Complete kit includes
• Toner Recharger
• Replacement felt
• Instructions
MORACK INCORPORATED
9132 Windsor Dr. Palos Hills, IL 60465
Order or Information (708) 598-0580 FAX (708) 598-9203
CANON* COPIERS PC 1,2,3,5,6,7,8,10,14,20,24,25 $19.95
LASER PRINTERS $19.95
SHARP* COPIERS 250 55 70 75 XEROX* 5008 $29.95

LISTEN TO CORDLESS PHONES, CELLULAR & more. Modified handheld scanner receives all! $199 + S/H. 6 Month Warranty. MC/VISA/ COD. **(314)569-4027.**

POTATO LAUNCHER, easy construction, 300' +, send $19.95 for plans. 17 North Ave., Attleboro, MA 02703

LASERS
FROM $10.00
(602) 934-9387
http://www.mi-lasers.com
FREE CATALOG
MEREDITH INSTRUMENTS P. O. Box 1724 Glendale, AZ 85301

SURVEILLANCE, COUNTERSPY, PROTECTION. Guaranteed Lowest Prices! Catalogs $5.00 PROTECTOR, Box 520294-A, Salt Lake City, UT 84152 (801)-487-3823

ULTRA BRIGHT LASER POINTERS
1 YEAR WARRANTEE
ALL METAL CONSTRUCTION
PUSH BUTTON POWER CONTROL
6 HRS 2 AAA BATTERYS
LAPN65 MOST VERSATILE..15mw equiv 2000 ft....*39.45*
LAPN63 BRIGHTEST.....30mw equiv 3000 ft....*79.45*
LAPN65D ELEGANT WITH BUILT IN WRITING PEN....*49.45*
LAPN65S SMALLEST AND LOWEST COST (plastic)..*29.45*

NEW CYBERNETIC EAR!
ENHANCES NORMAL HEARING 3 TO 4 TIMES!
ADJUSTABLE VOLUME CONTROL,FITS EASILY INTO EITHER EAR. MANY MANY USES.
CYBEREAR Ready to use....*19.95*
TURBOEAR Personal amplifier for both ears with voice filter....*19.95*

LASER WINDOW LISTENER
AIM AT WINDOW AND LISTEN TO SOUNDS FROM REFLECTED LIGHT.INCLUDES HIGH PERFORMANCE OPTICAL RECEIVER AND VISIBLE LASER. CAUTION-NOT FOR ILLEGAL LISTENING.
LWB5 PLANS- Creditable to hdwre purchase.....*10.00*
LWB5K KIT/PLANS- Includes working laser.....*149.50*
LWB50 READY TO USE- Requires Alignment.....*199.50*

ELECTRONIC HYPNOSIS AND MIND CONTROL
GENERATES HIGHLY EFFECTIVE AUDIBLE AND VISUAL STIMULI WITH BIO FEEDBACK THAT CAN INDUCE HYPNOTIC AS WELL AS ALPHA RELAXED STATES OF THE MIND.PLACE SUBJECTS' UNDER' YOUR CONTROL.REQUIRES A DEGREE OF CAUTION AND COMMON SENSE.
HEADSETS INCLUDED
MIND20 SYSTEM WITH HEADSETS minor assy....*79.50*
FREE CATALOG With order or send $1 Postage
INFORMATION UNLIMITED
PO BOX 716 AMHERST NH USA 03031
ORDERS ONLY...24 HRS....1 800 221 1705
TECH LINE..9 to 12 EST.....1 603 673 4730
FAX IT LINE.....24 HRS....1 603 672 5406
WEB SITE AT http://www.amazing1.com
WE ACCEPT CASH, MO, CHECK, MC,VISA. PLEASE ADD 5.00 SHIPPING&HANDLING AND ADDITIONAL 5.00 IF YOUR ORDER IS COD. FOREIGN CUSTOMERS ONLY ADD 20% OF ACTUAL ORDER TOTAL FOR SHIPPING.

DO-IT-YOURSELF

SURVEILLANCE-COUNTERSURVEILLANCE WE HAVE EVERYTHING! Catalog: $5.00 P.E.E., 2720 Stemmons, Suite 711, Dallas, TX 75207.

The Most Extraordinary Spy Catalog in the World! On the internet **http://www.spectre-press.com**

LASERS FROM $ 40.00!
We sell LASERs for experiments, light-shows, & Industrial applications. Learn about LASERs with our plans, books and kits.
See our complete catalog on the Internet.
HTTP://WWW.PWEB.COM/MWK/MAIN.HTM
MWK INDUSTRIES 1269W.POMONA CORONA, CA91720
CALL FOR YOUR FREE LASER CATALOG TODAY! (909) 278-0563 FAX: (909) 278-4887

UNUSUAL PUBLICATIONS! Strange stuff! Weird plans! **FREE** catalog 185+ amazing publications! Electromart, Box 4-P, Carthage, TX 75633-0004.

SURVEILLANCE HIDDEN CAMERAS
DIRECT FROM MANUFACTURER-BEST PRICE IN THE MARKET
Ultra miniature hidden camera, in dome, smoke or motion detector w/ mic. B/W or Color. Wide view angle. Low light sensitivity + super sharp images, plus video and audio output. From $159.00. Also 1/3" B/W board Cameras w/mic, only $99.00 USD. Plus $5.95 for S/H. Whole/Retail Welcome. COD, Check, Money Order or Visa/MC.
BOLIDE INTERNATIONAL CORPORATION
PH: (800) 355-0895 or (818) 575-8178
9660 Flair Drive #318, El Monte, CA 91731
http://www.bolideamazingproducts.com/

TELEPHONE SURVEILLANCE DEVICE
W/12 HR. RECORDER
Automatically record all incoming and outgoing calls!$99.95+ 5.00 sh. Telephone surveillance device $19.95+$2 sh (seperately)
VERY POWERFUL FM TRANSMITTER
Transmits voice to any FM radio up to ½ mi. Easy to assemble kit. Up to 9V (not incl.) $19.95 + $2 sh
For comprehensive 50 page catalog of Micro Video VHF Transmitters, Surveillance & Counter-Surveillance and much more! Send $3.00 Call 407-725-1000
1 x 1 ¾"
USI CORP
P.O. Box PS2052 Melbourne, FL 32902
COD'S OK

Surveillance Devices !
12 Hour Telephone Recorder
High quality, long - play cassette deck plugs directly into telephone jack! Records up to 12 hours of conversations on a single cassette. Recording starts and stops automatically when phone is used!
THR-12 $99.95
Smallest transmitters offered anywhere!
MD-250 Micro Dot *Tiny & Powerful Room Transmitter Kit*
The size of a dime! Professional quality Crystal clear reception on any FM radio up to 1/4 mile. "SnapKit" technology for easy assembly.Highest power & most sensitive transmitter offered!
$44.95
Telephone Transmitter Kit hidden in a dual modular adaptor
Transmits both sides of conversation to any FM radio up to 1/4 mile. "SnapKit" Uses phone line for power & antenna! Goes completely unnoticed.
MA-100 $25.95
Video Cameras!
Ultra miniature video cameras hidden in smoke alarm or alarm clock - your choice. High quality B/W with 420 lines. Direct RCA jack output of audio and video
SC-600 *TC-70* $189.95 ea.
Visa/MC Check/MO order line: free shipping **1 800 594 1047**
(972) 255-7490 Internet - http://www.why.net/home/sr/
Seymor-Radix Inc. Box 166055-P Irving,TX 75016

EDUCATION & INSTRUCTION

A FREE VIDEO External BA/BS, MS/MBA, PHD/LAW. Financial aid, (800)471-3776, LASALLE UNIVERSITY, Dept. #776, Mandeville, LA 70470-4000.

BE A DETECTIVE. Complete Home Study Training. Free Detective Career Kit. (800)742-9007-"H."

EDUCATION & INSTRUCTION

BEST QUALITY
UNIVERSITY DIPLOMAS, CERTIFICATES OF TRADE SCHOOL, MILITARY, LAW. FREE CATALOG. PO BOX 6188, HUNTINGTON BEACH, CA 92646.

CASINO RESEARCH TEAM discovers absolutely proven system. Verifiable $600+ daily. Literature: **1-800-341-5446.**

COLUMBIA SOUTHERN UNIVERSITY
Accredited External BS/MS/PhD.
Programs, Credit Life Experience
Free Catalog 1-800-977-8449, x.361

HOME INSPECTION. Study Course. FREE Literature. HRS, PO Box K, Chester, VA 23831. (800)494-6775.

LEARN PC REPAIR- TROUBLESHOOTING, SERVICING. HOME STUDY. FREE LITERATURE. P.C.D.I., ATLANTA, GEORGIA. 800-362-7070 DEPT. JJG109.

PARALEGAL GRADED CURRICULUM. Approved Home Study. Affordable and Comprehensive. 100 years of legal training. Free catalog (800-826-9228) Blackstone School of Law, P.O. Box 701449, Department PS, Dallas, TX 75370.

PRIVATE INVESTIGATION TRAINING! Big income! Own Boss! **FREE** Information. Probe, P.O. Box(PS) 2133, Beverly Hills, CA 90213-2133

UNIVERSITY DEGREES WITHOUT CLASSES. Bachelor's, Master's, Doctorate. Accredited, inexpensive, convenient. FREE brochure. Bears' Guide, 6923-PS Stockton Ave., El Cerrito, CA 94530. 800-835-8535. http://www.degree.net

ELECTRONIC SUPPLIES & EQUIPMENT

Long-Range Cordless Telephones. The Lowest Prices Anywhere. Excellent Sound Quality And Reliability. Call Today: 540-789-7888.

ELECTRONIC Project Kits. 1-888-GO-4-KITS. www.qkits.com
QUALITY KITS, 292 Queen St, Kingston, Ontario K7K 1B8.

EMBLEMS/ PATCHES/DECALS

CUSTOMIZED PATCHES, PINS, DECALS. FREE CATALOG, STADRI, 71R TINKER STREET, WOODSTOCK, NY 12498 (914)679-6600.

EMPLOYMENT INFORMATION

$329.84 Weekly Assembling Our Products At Home. Toll Free 1-800-460-WABC, Ext.1292 (Message).

EASY WORK! EXCELLENT PAY! ASSEMBLE PRODUCTS AT HOME. TOLL FREE 1-800-467-5566, EXT. 8068.

HELP WANTED

EARN MONEY. Reading books! $30,000 / yr income potential. Details. 1-800-513-4343 Ext. Y-20025.

GREAT EXTRA INCOME! ASSEMBLING CRAFT PRODUCTS AT HOME! GUARANTEED! **1-800-377-6000 EXT.6050.**

HOME TYPISTS, PC users needed, $45,000 income potential. Call 1-800-513-4343, Ext. B-20025.

EYE CARE

20/20 WITHOUT GLASSES! Safe, rapid, non-surgical, permanent restoration, 6-8 weeks. Airline pilot developed. Doctor approved. Free information by mail: (800)422-7320, ex. 362 or (406)961-5570. Fax: (406)961-5577. http://www.visionfreedom.com SATISFACTION GUARANTEED.

FINANCIAL

FEDERAL LOANS for small business now available. Call 1-800-777-6342 for free details.

FREE CASH GRANTS! NEVER REPAY ANY PURPOSE. THOUSANDS OF SOURCES. CALL FREE. 1-800-338-4398.

FREE CASH GRANTS. Never Pay Back! Business, Medical Debts, Others. Information SASE: GrantFinders, 5871 N. University Drive, #303, Tamarac, FL 33321.

FREE GOVERNMENT GRANTS! BILLIONS AVAILABLE! NEVER REPAY! CALL (24 HOURS): 1(619)599-3502

HOW TO make a fortune using credit cards. Free info pack. 1-800-286-8063

MAXED OUT CREDIT CARDS? Reduce payments and interest. NO FEE. Fast- EZ- Confidential. NCCS nonprofit **1-888-844-NCCS toll-free.**

MONEY AVAILABLE NOW! Let the Government Finance your business idea. Satisfaction Guaranteed! 1-800-226-3601, ext.BF6050

MONEY TROUBLES? OVERDUE BILLS? REDUCE INTEREST, CUT PAYMENTS, RESTORE CREDIT. CALL **1-800-SAVE-ME-2.**

OVERDUE BILLS? 1-800-788-1141. Bad credit's no problem! Licensed/Bonded since 1977. Applications to $50,000. Not loan company. Town & Country Acceptance.

VISA/ MASTERCARD. Bad credit/ no credit? Exciting news! Free info. 24 hours. 1-800-723-3355.

FOR INVENTORS

WORK DIRECTLY WITH
REGISTERED PATENT ATTORNEY & DEGREED ENGINEER
36 YRS COMBINED ENGINEERING & PATENT EXPERIENCE
U.S. & FOREIGN PATENTS
PATENT AND DEVELOP IDEAS WITH THE EXPERIENCE OF AN EXPERT.
FREE 228 PAGE BROCHURE.
CONFIDENTIAL ADVICE AND FORMS.
INTRODUCTION TO INDUSTRY, MARKETING PLANS, OFFSHORE PRODUCTION & PROTOTYPES
Also Specializing in Copyrights & Trademarks
Associates located near Patent Office
CREDIT CARDS ACCEPTED • 24 HOURS/DAY
MICHAEL I. KROLL
REGISTERED PATENT ATTORNEY
US PATENT REGISTRATION #26,755
171 STILLWELL LA., SYOSSET, NY 11791
TOLL FREE US/CANADA 800-367-7774
Toll Free FAX - US & Canada 800-367-7773
International Phone/Fax 516-692-2795
Internet-http:// invention.com
E-Mail: patent @ genie.com

BORSARI & Associates, provides professional patent and trademark services. For our inventor's package, call 800-225-2462.

DEAL DIRECTLY WITH REGISTERED PATENT AGENT and qualified U.S. Patent Office Examiner. DON'T BE FOOLED BY PHONIES. Free patent information- "Patent, Develop, Market Your Invention." Richard L. Miller, 12 Parkside Drive, Suite-N, Dix Hills, NY 11746-4879. (516)499-4343, 1-800-242-9853, HTTP://WWW.PTO-AG.COM

DON'T BE FOOLED! CALL OUR INVENTORS CLUB 24 HOURS FOR INFORMATION. 1-800-466-1793

FOR INVENTORS

Do you have a great idea? Ask us! We have evaluated over 11,000 inventions and advised investors for over 20 years. For your **free** inventor's kit call the Innovation Center- 1-800-265-4559

FREE help for inventors! No charge for protection forms and information kit. Affiliated Inventors Foundation. 1-800-525-5885

PROTECT YOUR INVENTION
The Law Firm of Goldstein & Associates
- Affordable and thorough Patent and Trademark searches performed at the United States Patent Office
- Patent & Trademark applications prepared & filed by experienced attorneys

FREE CONSULTATION–call for appointment
Call for a FREE color brochure
1-800-728-8165
New York • San Francisco
Beverly Hills • Washington, D.C.

FREE INVENTION PACKAGE: For customized development, patenting and licensing assistance on your new product idea, call Davison & Associates. Success stories available... 1-800-677-6382 or http:// www.inventegrationworks.com/

Have a Bright Idea?
Now **OWN IT** for only **$89**
Created By Gene Scott, Registered Patent Agent and Founder/Chairman of INVENTORS FORUM
- Provides "patent pending" status
- Easy, quick to do
- Avoids attorney fees
- Filing fee only $75

Do-It-Yourself ***ACTION KIT***™
Provisional Patent Application
(Congress' June'95 simplified application)
Kit incs. Video, Workbook, Examples and Forms
Patent Law & Venture Group
1-800-7-4-PATENT • 1-800-747-2836

Got a Great Idea? You need **INVENTOR'S DIGEST!** Answers ALL your questions! $22/ yr. 1-800-838-8808.

Got a Great Idea? You need **INVENTOR'S DIGEST!** Answers ALL your questions! $22 / yr. 1-800-838-8808.

Inventions, ideas, new products! Presentation to industry/ exhibition at national innovation exposition. Patent services. 1-800-288-IDEA.

INVENTION TECHNOLOGY. 1-800-841-1708. Help available. Patent pending, thirty days guaranteed. Prototyping/ Marketing.

INVENTOR'S CHOICE: Inventors make money from your idea. Step- by- step guidance. Patents, Business Plans, Licensing campaign, Marketing, Manufacturing, Seed- capital! Call now for brochure. 1-888-528-6249.

INVENTORS. ***URGENT MESSAGE* FROM WASHINGTON D.C.** 24hr recording. Toll Free 800-211-0893. Request packet 12.

INVENTORS -- NEVER SEND IDEAS TO STRANGERS! AVOID SCAMS - SAVE THOUSANDS! REVOLUTIONARY, PROTECTION/ MARKETING METHOD! NONPROFIT ORGANIZATION. FREE INFORMATION: 1-800-846-3228.

INVENT SOMETHING? ESI Inc. links unconnected individuals with decision-makers. Free brochure supplied. (800) 547-7885

FOR INVENTORS

PATENT IT ECONOMICALLY! Free details. Licensed since 1958. Near Washington, D.C., Ph.D. Associates. 1-800-546-2649

Put your invention on the **INTERNET.** No up-front fees. 1-800-553-9636. http://www.innovation-alchemy.com

QUALITY, Confidentiality. AFFORDABLE patenting and industry presentation. FINANCING AVAILABLE. Free information 1-800-501-2252.

REGISTERED PATENT ATTORNEY. Former patent examiner. 31 years experience. Donald Kettlestrings. 1-800-966-7577.

REGISTERED PATENT ATTORNEY. 33 Years Experience. Master's in Engineering. John Maier, III, 326 Wall Street, Kingston, NY 12401. 1-800-230-9496, 914-340-0010. FAX: 914-340-0099.

S.E.L.L. YOUR IDEA..... Free info. on Patents, Licensing, Marketing, based on 25 yrs Exp. Harshaw Research 800-451-1326

VERY EFFECTIVE LOW COST PATENTING/ PRESENTING TO INDUSTRY. 19 YEARS EXPERIENCE, FREE ADVICE, PHASE2, 1-800-446-4264

HEARING AIDS

Hearing Aids. Deal Direct, save hundreds, free trial. 1-800-641-4327. True Sound. FREE Info.

HEARING AIDS- New **FREE** Catalog. All styles available, including **POWERFUL CUSTOM AIDS**, at savings of 1/2 or more. Power Hearing, Box 31, Alpine NY 14805 1-800-260-4135

HEARING AIDS- GUARANTEED LOWEST PRICES! No huge commissions. Home trial, terms. All makes. We're the oldest, biggest, best. Custom instrument specialists. Free information,(800) 323-1212. Lloyds - PSC.

NEARLY FREE VIDEO. Learn why you hear but don't understand. Video explains hearing and hearing aids and a new way to get the right hearing aids without leaving your home. $5.95 shipping/ handling. Ethical Hearing Instruments. 800-875-6864.

FREE CATALOG!
New Hearing Aids

• 45 Day Trial • Huge Savings
TRY BEFORE YOU BUY!
1-800-320-3300 EXT R31
Write: RHODES HEARING
201R31 Ohio St.,
Brookport, IL 62910

HOME SECURITY

Insure thieves completely avoid your home. Info: $5.00. Kit: $20.00. DL SECURITY SYSTEMS, P.O. Box 1060, Upland, CA 91785.

HYPNOTISM

FREE HYPNOSIS REPORT! WRITE: JKL, 384 PENOBSCOT BUILDING, DETROIT, MI 48226-S

INVENTIONS WANTED

FREE Invention Kit: Patent and Market your new product idea! Call Concept Network 1-800-846-8368.

INVENTIONS WANTED

HONG KONG factory need several new pr ducts for their oversea buyers. Send produ ideas for royalty evaluation. Can produce excl sively. Hong Kong Plastic Metal Products Cor pany, Box 69627, Kwuntong, Hong Kong.

Inventors: Free information on offering yo invention for sale. 1-800-537-1133. Kessl Sales Corporation, C-7-IW-7, Fremont, Oh 43420.

INVENTORS: Free information package, expe ienced patent attorney in Washington, DC are 800-876-6670, J.P. Halvonik

RISK- FREE MARKETING OF IDEAS. See ing new ideas for marketing to industry witho up- front fees. New Ideas Corporatio **1-800-797-IDEA.**

KITES

KITES
FREE COLOR CATALOG
Choose from over 200 kites.
Many unusual & innovative designs.
Call or write for your catalog today!
Into The Wind • (800) 541-0314
1408-P Pearl St., Boulder, CO 80302

LOANS BY MAIL

DEBT CONSOLIDATION. NO ONE REFUSE FREE APPLICATION. CALL: 800-441-301 GLOBAL 24 HOURS.

SIGNATURE Loans, must have checking a count & steady job. Call 1-800-445-0680.

MAGIC/NOVELTIES

THE HAUNTED HOUSE HANDBOOKS. Th definitive collection of do - it -yourself horr effects. $20. Brains, Box 939, Knightdale, N 27545.

MATTRESSES

NEW, BEST BACK SUPPORT, Lowest Pre sures, Patented Swedish- Foam/ Leversprin Mattress. **FREE** Sample. Also: Airbeds, Wate beds, Adjustable Beds. **WWW.STROBEL.CO** 1-800-457-6442.

MONEYMAKING OPPORTUNITIES

CRAPS! Amazing, revolutionary system. Thou sands of satisfied customers. Free recorde information. 1-800-217-7711.

HOT BUSINESSES Free Dealerships $2.0 shipping. Fabtronics Wholesale, 571 Wautoma, Hilton, NY 14468-9126.

MONEY IN YOUR MAILBOX! Everythin needed to profit in mailorder. FREE INFO. Le Eneterprises, PO Box 763, Watertown, W 53094

WIN 2-5 CASH3 WEEKLY. HIT FANTASY LOTTERY, POWERBALL, TEL.770-339-752 Box 1107, Suwanee, GA 30174-0962

MOTORCYCLES/BICYCLES

DIMENSION EDGE BICYCLE ENGINES: Aux liary Power Supply Fits Bicycles, Recumbent Fold-ups, Easily. Aluminized System Ou powers, Outclimbs, Outpaces Competitors. Fre Brochure. 406-245-5380

NEW PRODUCTS

BREAKPROOF. Guaranteed, High Impact, Ce ramic lenses, 100% UV-ABC, utmost perform ance sunglasses. 1-888-EYESAFE.

Copyrighted material

NEW PRODUCTS

REMOTES FOR ANY APPLICATION

Security
• 70 Billion Rotating Codes • **Never** Repeats the Same Code Twice! • Micro Remotes • Great Range • Used by the FBI, Dept. of Justice, Royal Canadian Mounted Police and Federal Buildings
$99.95

Receiver/Remote for 3 Devices

Useful Applications
• Garage Doors • Keyless Entry for Cars • Home Automation Equipment • CCTV Cameras • Switch Anything On/Off
STREET SMART SECURITY
619-462-1167 • (FAX) 619-462-0652
http://www.vanet.com/sss/

CAD LOADER Build It Yourself Front End Loader

Plans to build and use
• No machining
• Under $700 to build
• In use over 2 years
• Kit Available
• Free Brochure

CAD plans corporation
P.O. Box 606, Dept. S • Daleville, VA 24083 • 1-800-817-5267

ELECTRONIC INSECT SWATTER!
Hi tech, handheld. Uses electronic shock to kill insects wherever they appear. Won't soil surfaces. Excellent for use at home, in restaurants and hospitals. Only $19.95 (USD) + $4.95 S/H in USA, Canada. Visa/MC, Check, Money Order or C.O.D. **30 DAY MONEY BACK GUARANTEE!**
BOLIDE INT'L CORPORATION
(800) 355-0895 or (818) 575-8178
9660 Flair Dr. Suite #318, El Monte, CA 91731
http://www.bolideamazingproducts.com/

OF INTEREST TO ALL

ATTENTION DEFICIT --Conquer without drugs. Free info for SASE. P.O. Box 912, Greenbelt, MD 20768

GROW TALLER! FREE REPORT. SHARP LABS , 100 New State Hgwy, Raynham, MA 02767

MEET PENFRIENDS WORLDWIDE! FREE DETAILS! PIC, BOX 461873-PS, LOS ANGELES, CA 90046.(213)650-1994.

PLANS/KITS/BLUEPRINTS

18" MODEL DOME KIT! Unique! Complete! Moneyback! $12 Postpaid: Domes; 3951 Freels Rd.; Friendsville, TN 37737

Dome Homes - Pre-cut kits - Superinsulated - Dome Tour Video - Natural Spaces 1-800-733-7107.

Sequence Flasher Kit with E-Z Instructions. Light up Models Crafts & Projects. $27.00 Star Gate, 1370 Kael #5, Florissant, MO 63033

The Monolithic Dome is a super-strong, insulated, concrete dome that is energy efficient and impervious to disaster. Used for homes, offices, schools, churches, gymnasiums, storages, cabins, shops, and more.

You can build your own Monolithic concrete dome, too.
Call **1 (800) 608-0001** for a FREE COLOR brochure or send $19.95 plus $5 shipping for our 60 minute information video
PO Box 479-PS • Italy, TX 76651 • http://www.monolithicdome.com

PLASTICS

CASTOLITE Liquid Plastics. Crystal clear, colors. For casting, embedding, coating, fiberglasing, repairing and reproducing with our Mold Making Supplies. Catalog $3.00 refundable. CASTOLITE, Dept. 97G/PS, 4915 Dean, Woodstock, IL 60098.

Rubber, plastic compounds, techniques, sources. Free information: Castcraft, Box 7000(V96), Memphis, TN 38187-1000.

REAL ESTATE

BARGAIN HOMES - Foreclosed, HUD, VA, S&L bailout properties. Low Down. Fantastic savings. Call 1-800-513-4343 Ext. H-20025 for list.

CALIFORNIA. Acreage. Lots $50 down. $50 monthly. 4602 Ethel Ave., Sherman Oaks, CA 91423

GOVERNMENT LAND now available for claim. Up to 160 acres/person. Free recorded message. (707) 448-1887. (4JG6)

REAL ESTATE

GOV'T FORECLOSED homes from pennies on $1. Deliquent Tax, Repo's, REO's. Your Area. Toll Free 1-800-218-9000, Ext. H-6586 for current listings.

LET THE GOVERNMENT PAY for your new or existing home. Over 100 different programs available. Free recorded message. 707-448-3818. (8JG6).

MONTANA & WYOMING
Trees, Creeks and Wildlife. 35 acres starting at only $14,900. Many other properties and sizes available. Easy Owner Financing. No Time Limit Guarantee. Warranty Deed. Guaranteed Access. Call today for free information & photos.
Rocky Mountain Timberlands
1315 East Main • Dept. PS, P.O. Box 1153
Bozeman, MT 59771-1153 • (406) 586-8088
Call Toll Free: 1-800-682-8088

GOVERNMENT LAND
US CITIZENS ONLY
20-160 acre claim program still available, get yours for $20 government fee, in AK, AZ, AR, CA, CO, ID, MT, NV, NM, OR, UT, WA, WY. For complete, step-by-step package including maps, telephone helpline, filing forms, etc. send $20; or for more information send $3. PUBLIC LANDS TITLE, PO Box 2945-PS Port Angeles, WA 98362-0336 (this is not Homesteading, it's much easier and only costs $1. per acre).
http://www.olypen.com/publiclands/

REMAILING SERVICES

CONFIDENTIAL ADDRESS. FORWARDING WORLDWIDE. VOICEMAIL. MAILPOST, 2421PS Pratt, Chicago, Illinois 60645, 773-764-0100, 800-890-3199
http://www.netcom.com/~mailpost

ROBOTICS

RUBBER STAMPS

Order "CUSTOM MADE"
RUBBER STAMPS
Size Approx.: 5/8" x 2"
A Great Gift!
UP TO 4 LINES only **$2.95** each
(Max. 30 letters per line)
INK PADS only $1.95 ea
(Specify color: Black, Blue, Red, Green)
Add 75c per order for postage & handling
THOUSANDS OF SATISFIED CUSTOMERS!
FAST SERVICE - Your Order Shipped in 5 Days!
QUALITY Stamp Mfg. Box 35514-S Tulsa OK 74153

SATELLITE TV

DSS TEST CARD INFORMATION!! & EVERYTHING ELSE YOU WANT. 1-800-345-7800.

FREE CATALOG. World's Best Selection Listing Books, Videos, Software On Satellite TV. (800)483-2423.

OBTAINING SOUND for your **VCII** and **VCII PLUS** is easy. No codes Needed. Also **DSS TEST CARD** information. Details **1-800-211-5635.**

SATELLITE MINI-DISH $99.00. Plus $300 Programming. **LOWEST PRICE ANYWHERE.** Considerably Better Than Cable. 1-800-244-0209.

SATELLITE TV

SATELLITE TELEVISION PAYS! Minidish sales force needed. **STAR VISION DIRECT.** 1-800-899-9707, 8am - 10pm Pacific.

SOUND for VIDEOCYPHER-II and plus. Free details. SASE: NASSIRIAN, Box 382-S, Rio Linda, CA 95673.

Digital Entertainment GREAT VALUES ON: USSB dish AlphaStar
SAVE Compare to Cable **30%-50%**
MORE ENTERTAINMENT OPTIONS
ALL THE HOT ACCESSORIES
PAY LESS
Fax: 218-739-4879
Int'l: 218-739-5231
1032 Frontier Dr.
Fergus Falls, MN 56537
Call Now 800 500-9264
www.skyvision.com
Skyvision

SCIENCE & CHEMISTRY

Build your own Rockets and Motors. **30,000 FT/ 2,000 LB THRUST.** Information Packet: $3.00. U.P.T., 1085 Darnell Rd., Jefferson, GA 30549.

"Laboratory" Glassware, Chemicals.Catalog $2.00. Southern Oregon Scientific, 1000 SE M Street. Unit A, Grants Pass, OR 97526 HTTP://www.cdsnet.net/Business/SOS

LABORATORY CHEMICALS, GLASSWARE, INSTRUMENTS, STUDENT KITS, CATALOG $5.00. ADVANCE SCIENTIFIC, 2345 S.W. 34TH STREET, FORT LAUDERDALE, FL 33312. (954)327-0900 http://www.advance-scientific.com

MAKE YOUR OWN ROCKET MOTORS!!! HOMEMADE FUELS,"CHEMICALS", Lab Glassware, Acids, Supplies, Instructional Books, Etc. "HUGE CATALOG" $2.00. PYROTEK, P.O. BOX 300, SWEET VALLEY, PA 18656. (717)256-3087.

Space Compass. Two experimental instruments on motion in space. $9.95: Salvo Distribution, P.O. Box 1733, Summerville, SC 29483

SCIENCE & HOBBIES

SCIENCEKITS.COM for chemistry, electronic, robots, astronomy, more. Great fun and educational! **WWW.SCIENCEKITS.COM**

SECURITY/SURVEILLANCE

STOP AUTO ALARMS! Portable, easy to build. Plans $19.95, Kit $69.95 (305)271-2737

STAMP COLLECTING

300 Breathtaking Stamps. $1.00. Plus fantastic approvals!! NeoTrends, SF97, Box 982F, Toronto, Canada M4Y2N9.

DISCOUNT, STAMPS, PACKETS, FREE LIST IVA, BOX 197-B, HANFORD, CA 93232

FREE! Big New Catalog full of bargains on stamps, packets, albums, and supplies. Plus collector information and stamps on approval. Buy what you like- return balance. Jamestown Stamp Company, Dept. E67PS, Jamestown, NY 14701.

Penny Stamp Approvals, Regardless Catalog. Kloster 18289 Bunny Drive, Jamul, CA 91935.

TELECOMMUNICATIONS

FORGET CELLULAR FEES
FREE, unlimited talk time. Anyone. Anywhere. Anytime. Guaranteed. No monthly or per-minute charges. Absolutely legal!!! The secret cell-phone companies don't want anybody to know. For complete details & compatible-model list send $14.95 & SASE: Or for more info and coupon $2 & SASE:
Underground Information 530 Showers Dr. #7-286 Mt. View, CA 94040-1000

TOBACCO/PIPES/CIGARS

HANDMADE CIGARS, Imported and domestic, free list,1-888-76-CIGAR, L. Lynn Cigars

TOOLS & MACHINERY

4" Metal Cutting Lathe $135.75. Taig, 12419 Nightingale Lane, Chandler, AZ 85249.

BOLTS, SCREWS, TOOLS, WHOLESALE, DIRECT. Guaranteed. Catalog $2.00 (refundable). Camelot, Dept. 33, Box 65, Bristol, WI 53104.

LATHES
Compact 5
•Starting at $ 410
•Mills •Metals •Books
•Precision Instruments
Free Catalog
513- 322-8562 (800 number for orders)
CAMPBELL TOOLS COMPANY
2100-P Selma Rd., Springfield,OH 45505

BLUE RIDGE MACHINERY AND TOOLS, INC.
Free Machine Tool Catalog
PO Box 536-PS, Hurricane WV 25526
304-562-3538 fax 304-562-5311
JET EMCO-MAIER SHERLINE

WANTED TO BUY

Gold, Silver, Platinum (any form). Assaying service. Free price quotes. Top payment. 1-800-932-1010/ 617-326-3442

WATCHES/TIMEPIECES

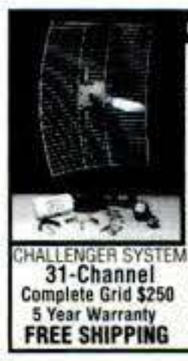
REPLICA SWISS WATCHES... 18kt Gold-plated! Lowest! 2Y Warranty! Waterproof! (770)682-0609, FX(770)682-1710

WATER PURIFICATION

Electronic Water Softener no chemicals or plumbing needed, removes limescale from pipes, perfect for septics, moneyback guarantee, $399.95 call **EcoSoft** 1-800-275-7070

PURE
Home Appliance Purifies Your Tap Water
Drinking Water
Free Catalog 1-800-874-9028
Waterwise® Inc
PO Box 45984 Center Hill FL 33514-0459

WIRELESS TV

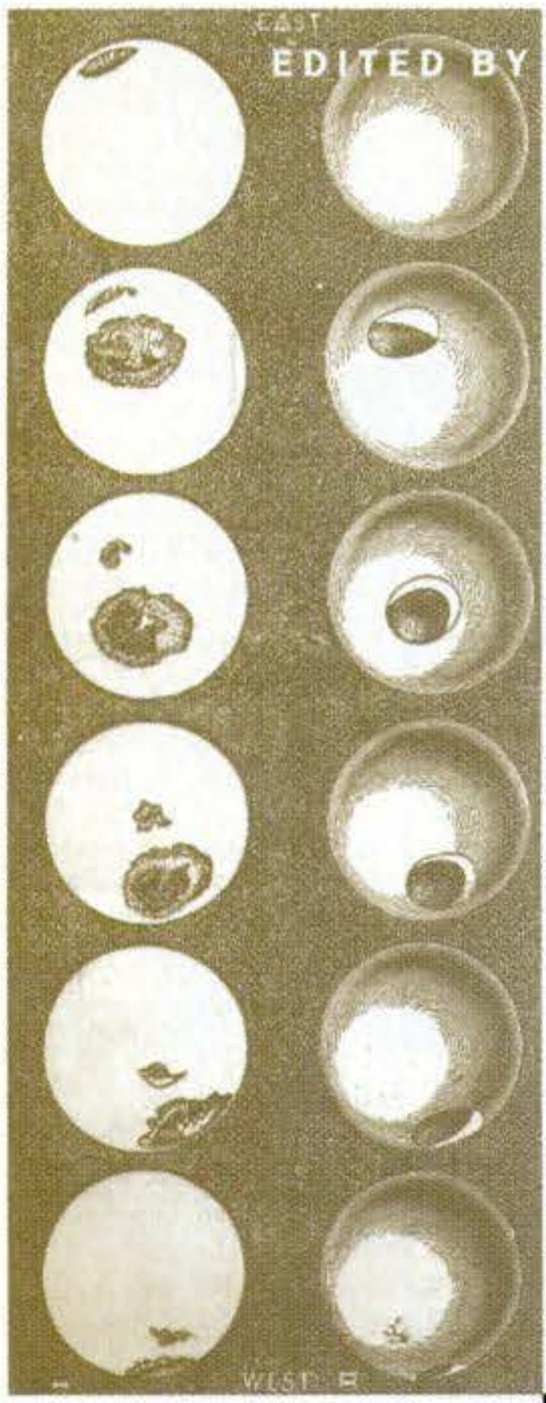


Quality Microwave TV Systems
WIRELESS CABLE - ITFS - MMDS
ATV - INTERNATIONAL - DIGITAL
Amplifiers • Antennas • Books • Components
Filters • Systems • Video Products
• RF Frequency 1990 - 2700 MHz
• Cable Ready - VHF - UHF Outputs
• SASE For "FREE" Catalog or Send $1
PHILLIPS-TECH ELECTRONICS
PO Box 8533 • Scottsdale, AZ 85252
CHALLENGER SYSTEM 31-Channel Complete Grid $250 5 Year Warranty FREE SHIPPING
ORDER LINE 800-880-MMDS
CATALOG / INFO 602-947-7700
FAX LINE 602-947-7799
Visa • M/C • Amx • Disc • COD's • Qty Pricing

TO ADVERTISE IN THIS SECTION CALL 800-445-2714

Popular Science reserves the right to refuse any advertising order. Only publication of an advertisement shall constitute final acceptance of an order. Publication does not constitute an agreement for continued publication. All orders are subject to the applicable rate card, copies of which are available upon written request sent to the address provided.

Copyrighted material



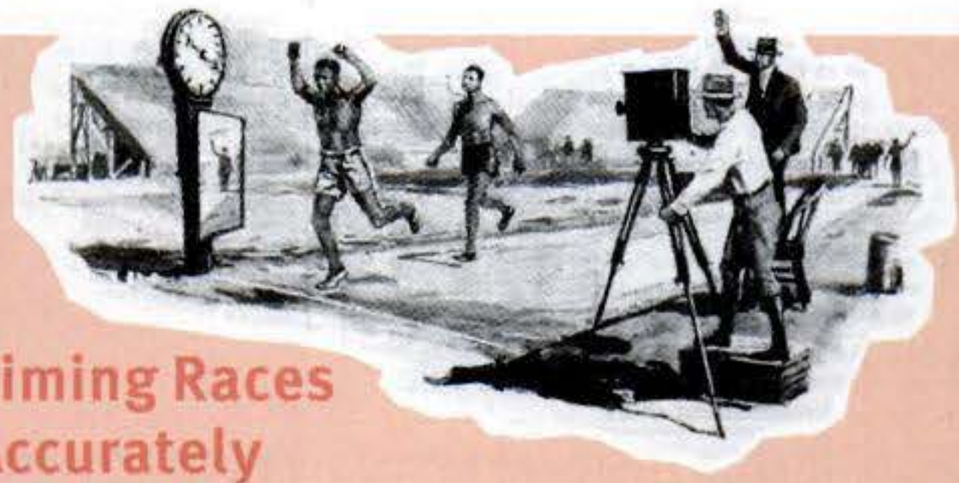
EDITED BY BOB SILLERY

SAMPLING 125 YEARS OF *POPULAR SCIENCE*

Spots on the Sun

125 YEARS AGO WHEN WE look at the sun through a telescope, we see it irregularly sprinkled with dark points, the appearance of which changes as the sun rotates (left). The establishment of a connection between the periodic appearance of these spots and the incidence of magnetic disturbances on Earth is "an event of great moment."—*June 1872*

The appearance and cyclical nature of sunspots are now believed to be caused by the sun's changing magnetic fields.



Timing Races Accurately

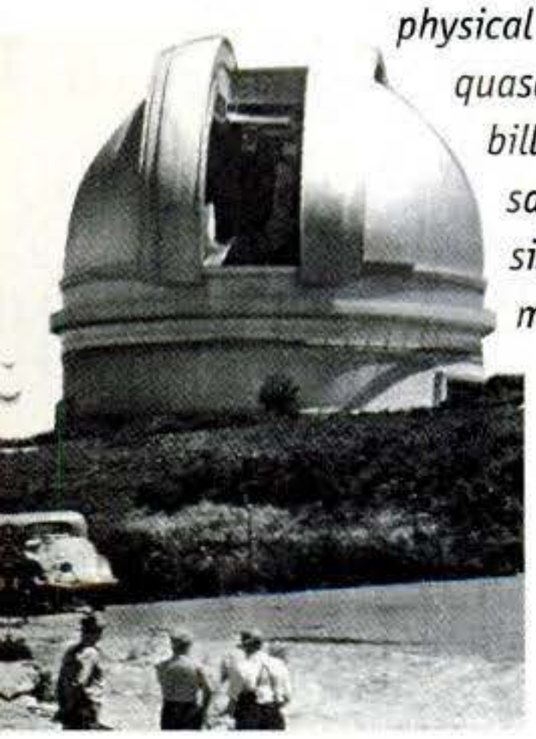
75 YEARS AGO A FEW FEET of moving-picture film will make exact timing possible at track meets. Filming starts before the race begins. The flash of the pistol in the mirror signals the start of the race; the time on a clock showing seconds and tenths of seconds is also captured. After the finish is recorded, it's a simple matter of subtracting the first time from the last.—*June 1922*

At the 100th Olympiad in Atlanta last year, an array of three cameras set up by Swatch Timing and Swiss Timing captured images at one-hundredth of a second.

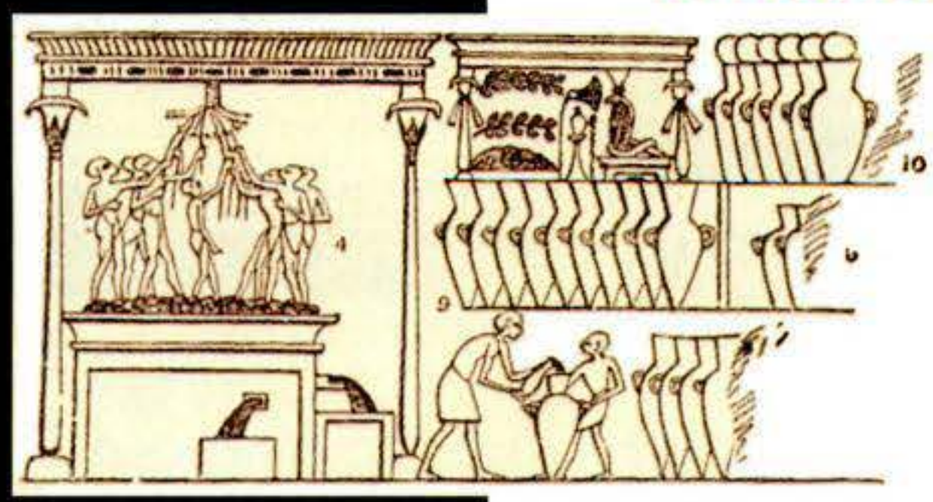
Gateway to the Universe

50 YEARS AGO THROUGH THIS dome, the telescope built by the California Institute of Technology will focus its 200-inch eye on stars as far away as a billion light years. The Palomar telescope lets astronomers peer four times farther into space.—*June 1947*

Our understanding of the power of telescopes like the Palomar 200-inch has grown with our knowledge of outer space. "The Palomar telescope can see to the limits of the physical universe, including quasars as far as 10 to 12 billion light years away," says Robert Brucato, assistant director at Palomar Observatory. "When scientists discovered quasars in the 1960s and learned how far away they really are, the whole idea of how far we can see with the telescope changed."



The History of Alcohol



100 YEARS AGO MANKIND seems to have a natural craving for some drug that shall "drive dull care away." As alcohol possesses this power, it has been used from the earliest ages and is still being used by rich and poor, high and low, civilized and uncivilized, in more or less complete disregard of the evils of overindulgence. Egyptian murals show the influence of alcohol on everyday life—at left, grapes being pressed and wine being stored.—*June 1897*

Fail-Safe Tire

25 YEARS AGO DUNLOP'S tubeless tire lets you drive safely after a blowout, at near-normal speeds. The specially shaped rim is only 60 percent as wide as the tire tread. On deflation, sidewalls collapse straight down to let the rim ride squarely on the tread. Then, lubrication inside is added as a capsule of oily liquid bursts under the weight of the car.—*June 1972*

Michelin, Goodyear, and Bridgestone-Firestone are among the tiremakers that now sell run-flat tires which, unlike Dunlop's pioneering effort a quarter-century ago, do not require special rims. These run-flats use thick, stiff walls that prevent the rims from collapsing.

Photocopy Permission Permission is granted by Popular Science® for libraries and others registered with the Copyright Clearance Center (CCC) to photocopy articles in this issue for the flat fee of $1 per copy of each article or any part of an article. Send correspondence and payment to CCC (21 Congress St., Salem, Mass 01970); specify CCC code 0161-7370/85/$1.00— 0.00. Copying done for other than personal or reference use without the written permission of Popular Science® is prohibited. Address requests for permission on bulk orders to Beth Barber, L.A. Times Syndicate, Intl., 2 Park Ave., New York NY 10016 for foreign requests. For domestic requests, write or call Reprint Management Services, Inc., 147 West Airport Rd., P.O. Box 5363, Lancaster, PA 17606-5363; 717-560-2001 (FOR ARTICLE REPRINTS ONLY). Popular Science® is a registered trademark of Times Mirror Magazines, Inc.

POPULAR SCIENCE **Business and Executive Offices:** 2 Park Ave., New York NY 10016. **Editorial Offices:** Address contributions to Popular Science, Editorial Dept., 2 Park Ave., New York NY 10016. We are not responsible for loss of unsolicited materials. They will not be returned unless accompanied by return postage. Microfilm editions are available from Xerox University Microfilms Serial Bid Coordinator, 300 N. Zeeb Rd., Ann Arbor MI 48106. **Subscription Inquiries:** Send new or renewal subscriptions or change of address (send both new and old addresses) to Popular Science, Box 51286, Boulder, CO 80322. Allow six to eight weeks for change of address. If you have a subscription problem, please write to the above address. **Subscriptions:** U.S. and its possessions, 1 year $17.94; 2 years $24.95; 3 years $29.95. For Canada, add $7 per year (includes GST). For Foreign, add $8 per year. Subscriptions processed electronically. **Postmaster:** Send change of address notices to Popular Science, Box 5100, Harlan IA 51537. Popular Science entered as periodical postage paid at New York NY and additional mailing offices. Canada Post Canadian Publications Mail Product Agreement No. 56219. Canada GST Registration Number R-122988066. Popular Science (ISSN 0161-7370) is published monthly by Times Mirror Magazines, Inc., 2 Park Ave., New York NY 10016.

Copyrighted material

TELL YOUR BUDDIES YOU JUST GOT A 4,100-LB. POWER TOOL.

The right tool for the right job. That's the Toyota T100 Xtracab truck. With its 190-hp V6 engine this full-size workhorse has more standard towing and payload capacities than Ford and Dodge.* Add to that a welded steel cab and a rugged double-walled bed and you've got one tough truck with a surprising level of comfort and sophistication. Toyota Trucks. Always come through.

Call 1-800-GO-TOYOTA or visit our website at: http://www.toyota.com for a brochure or full-line CD-ROM plus the location of your nearest dealer. ©1996 Toyota Motor Sales, U.S.A., Inc. Buckle Up! Do it for those who love you. Toyota reminds you to Tread Lightly!® on public and private land. *Comparison based on comparably standard-equipped Xtracabs with manual transmission.

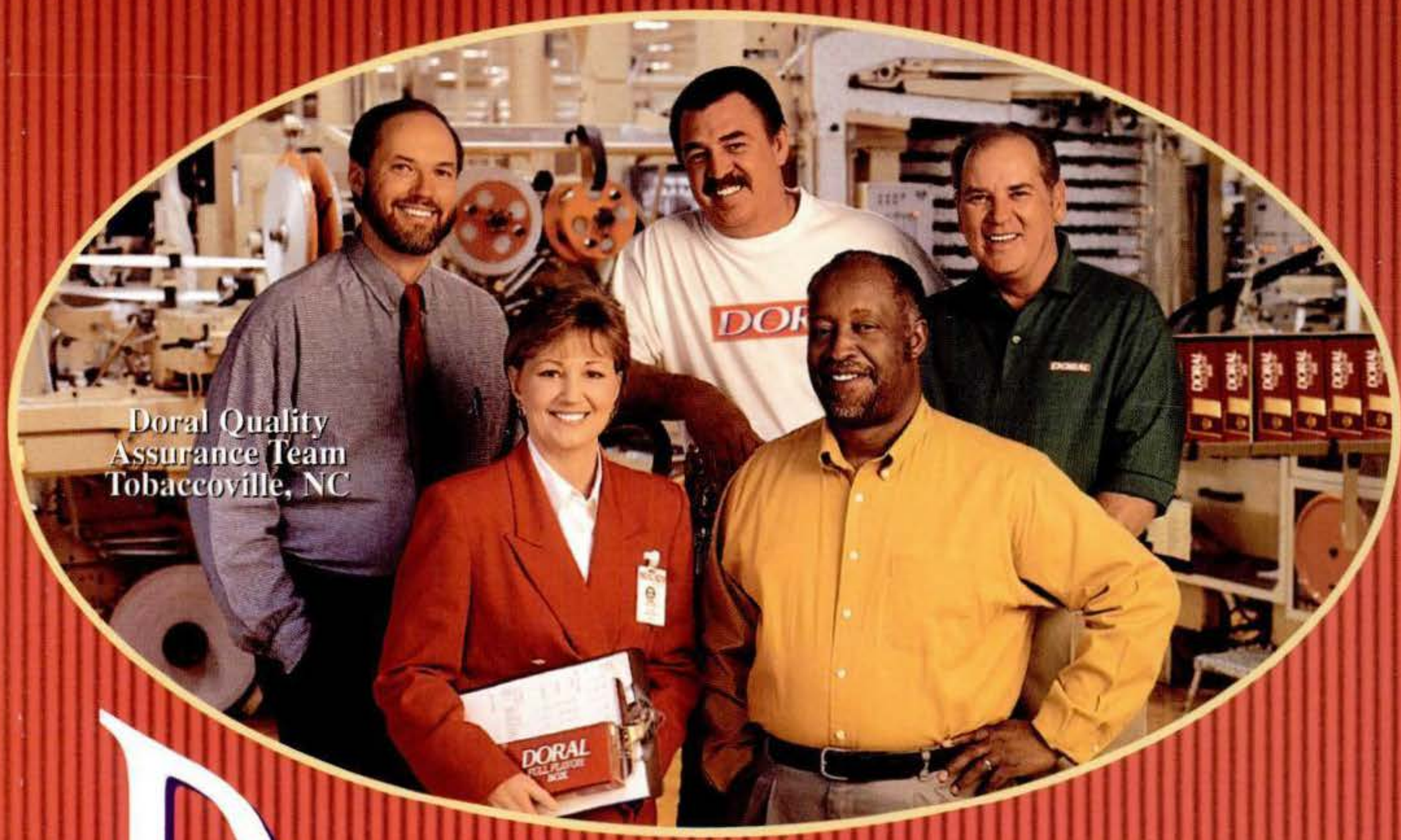
TOYOTA T100
I love what you do for me

Copyrighted material

©1997 R.J. REYNOLDS TOBACCO CO.

14 mg. "tar", 0.8 mg. nicotine av. per cigarette by FTC method.

DORAL



Doral Quality Assurance Team
Tobaccoville, NC

Promises

We give you premium taste or your money back.
It's not just a guarantee, it's our promise.

Discover The Doral Difference.

SURGEON GENERAL'S WARNING: Quitting Smoking Now Greatly Reduces Serious Risks to Your Health.

Questions about our Premium Taste Guarantee?
Call us at 1-800-74-DORAL (36725).

Copyrighted material